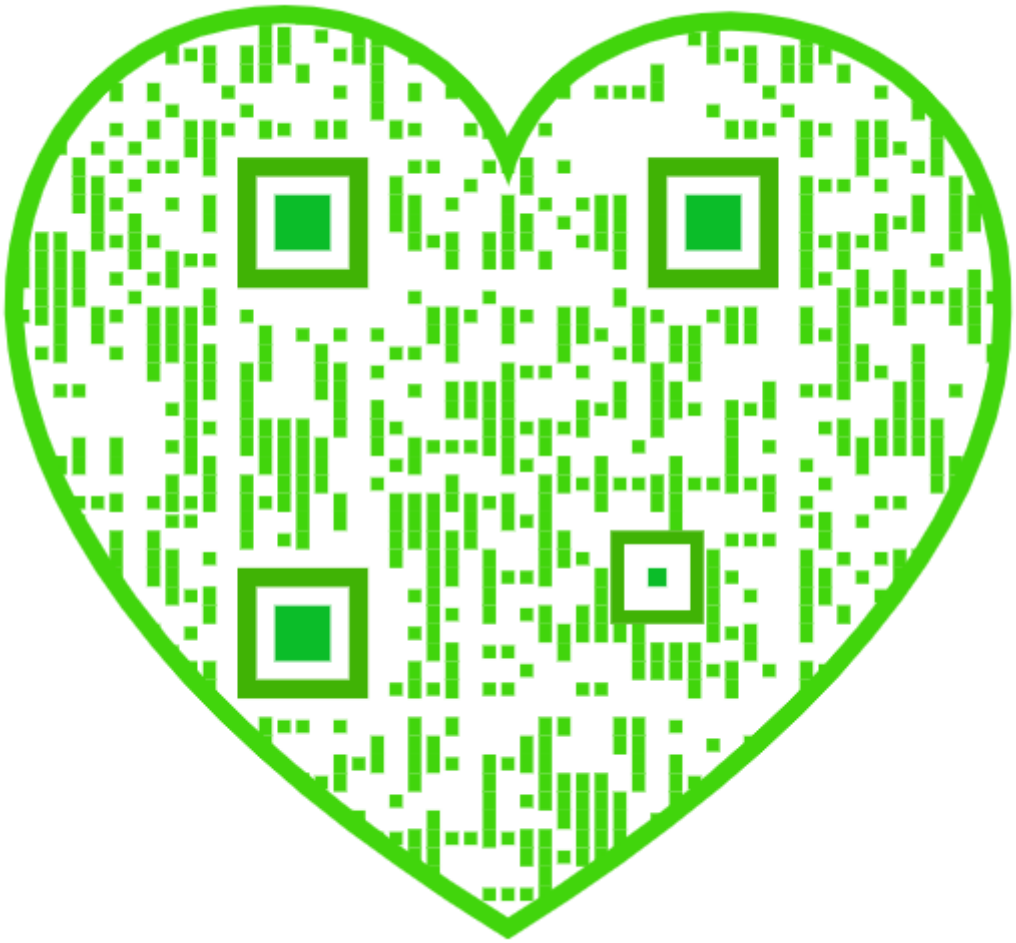

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THE

HANDY BOOK

OF

BEES

BEING

A PRACTICAL TREATISE ON THEIR PROFITABLE MANAGEMENT

BY

A. PETTIGREW

WILLIAM BLACKWOOD AND SONS
EDINBURGH AND LONDON

A. E. BENT.

PREFACE.

Dr M'Kenzie, in a small book on bees, says he was induced to study the subject from the fact that one of his two labouring men having found a swarm of bees in a hedge, and therewith commenced bee-keeping, was enabled afterwards to go without his wages till they were earned. Previously, both labourers got their wages in advance. The lift given to the one man by the possession of this fugitive swarm was so great and pleasing to the Doctor, that he commenced to read works on bees, and study their management both in this country and on the Continent. By-and-by a small fourpenny book on the subject fell from his pen, which received no patronage.

This little incident is mentioned to show what a swarm or two of bees may do for a poor labourer. Indeed, if there is anything more profitable to cottagers living in the country or on the skirts of towns, than a few swarms of bees, and can be more easily managed by them, all we can say is, we have never seen that thing, or known what it is. "Bees," says Cobbett, "are of great use in a house, on account

of the honey, the wax, and the swarms they produce —they cost nothing to keep, and want nothing but a little care."

The author's father, James Pettigrew, was a labouring man, and perhaps the greatest bee-keeper that Scotland has ever produced. He was so successful and enthusiastic in the management of his bees, that he earned and received the cognomen of "The Bee-man," and by this name he was well known for thirty years in a wider circle than the parish of Carluke, Lanarkshire, in which he resided. Even the district of the parish in which he lived when he kept most hives took then the name of "Honey Bank," which it still bears. And though the author left his native village thirty-five years ago, he is best known there on an occasional visit as "The Bee-man's son."

While a common labouring man, he saved a great deal of money from his bees; indeed it was reported in the Glasgow newspapers that he realised £100 profit from them one season. His example and success twenty-five years after his death have not yet lost their influence on the successful bee-keepers of his native village, who say, "The old bee-man taught us all we know; who taught him?" "The bee-man" saved money enough to purchase the Black Bull Inn of the village, and therein commenced business as a publican and butcher. When his sons reached their 'teens, the management of his bees was left in great measure to them. It was then that the foundation of what we know of bees was laid. And as most readers of a book like to know a little of the

author, we may be pardoned the egotism of saying that we were at the age of eighteen apprenticed to the profession of gardening at Carstairs House. In about four years afterwards we went to London to pursue our profession, which we have followed ever since. While an apprentice at Carstairs, and a journeyman in Middlesex, we kept bees in "hidden places" in the plantations and shrubberies; and while acting in the capacity of head-gardener, we managed the bees of our employers. Now we have a small garden of our own, in which we keep "lots of bees" for profit. Such is a brief outline of the author's history from a bee-keeping point of view. The work before the reader, then, is a practical one, and written by a practical man.

Three or four years ago, we were induced by our respected friend Mr Thomson, editor of 'The Gardener,' to contribute a series of articles on Bees for that periodical, then called 'The Scottish Gardener.' Mr T. heralded these articles with a few remarks rather too complimentary. He then said: "We had practical proof of the extraordinary success resulting from Mr Pettigrew's system of bee-management when he was our foreman in the Gardens at Wrotham Park, Middlesex, twenty-five years ago. We assure our readers who may peruse his letters, that though he may recommend what may clash violently with their present knowledge of the subject, he is, notwithstanding, a safe guide; and that, where profit is the object, no writer that we have ever read can be compared with him. We predicate that his letters will

be of far greater value to all interested than the cost of the journal for many years to come."

Bread is the first consideration of man. After food and clothing are obtained, he may seek recreation, music, society, knowledge, or anything else lawful. So in bee-keeping we reckon the question of profit is of first importance. Stings do not seem half so painful to the man whose annual proceeds of bee-keeping amount to £10, or £20, or £50.

But in addition to the profits of bees, there is a fund of interest and enjoyment derived from keeping them, uplifting in its nature and tendencies. One of the most pleasing sights on earth is that of a son of toil, after the labour of the day is done, taking a child in his hand, and going to see his pig, or cow, or bee-hive in his garden. Who has not seen hundreds of working men blessed and charmed beyond description in attending to their bees and cows? Such men are superior to the low vulgarities of the public-house, and superior in every sense to those who waste their time and strength in drinking. We hold that all employers of labour would do well to encourage their servants to spend their leisure hours in a profitable way. In country places and villages the gift of a few swarms of bees to deserving servants, and a practical treatise on their management, might become a source of perennial income and pleasure to them, and be, in fact, a greater boon and benefaction than a row of cottages *à la* Peabody.

The author, who is a working man himself, humbly greets working men on the completion of this work,

which has been written with an eye to their welfare, and with the hope that the "finger-posts" herein set up will guide many of them along the highroad to great success in bee-keeping.

There is no literary merit at all in these pages; in fact the author knows that the reader of taste and education will find much to "wink at." There is a great deal of repetition, and sometimes "nouns" keep out the "pronouns." There has been the strongest desire possible on the part of the author to write in the plainest and simplest style and manner, so that the most untutored man in England that can read, would not fail to catch the meaning of every page presented to his eye. The grand old words of the grand old parable of "The Sower" are worth repeating in every preface: "When any one heareth the Word, and *understandeth it not*, then cometh the wicked one and catcheth it away; but he that heareth the Word, and *understandeth it*, beareth fruit, and bringeth forth, some an hundredfold, some sixty, some thirty."

Rusholme, Manchester,
March 1, 1870.

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PART FIRST

THE

HANDY BOOK OF BEES.

PART FIRST.

At certain times of the year, in every healthy hive of bees, there are a queen or mother bee; males, which are called drones; and working bees. There are also honey and wax, bee-bread and propolis.

Queen.

Worker.

Drone.

CHAPTER I.

THE QUEEN BEE.

Her Shape and Appearance.—By looking at the representation of the different bees, the reader will see that a queen is less in size than a drone, and larger than a

working bee. In shape she is more like a worker than a drone, but more genteel and beautiful than either. Her abdomen or belly is comparatively very long, and gradually and gracefully tapers to a point—giving her an appearance quite distinguishable and different from all in the hive. She is really a queenly creature, and modest and graceful in all her movements.

Mother and Monarch.—Being mother and monarch of the hive, her life is very precious. The loyalty of her people, and the activity and vigilance of her "body-guard," are most remarkable. No human monarch was ever half so well attended to by his subjects as a queen bee is by hers. The life and prosperity of a hive depend on the presence of a queen—a queen moving and reigning in the hive—or in prospect—that is, in embryo; for when a queen dies, or goes with a colony or swarm, she leaves behind her some princesses in their cells, or infant state; or eggs which the bees hatch into queens. If a hive lose its queen without expectation of getting another, all prosperity comes to an end—the contentment, loyalty, and industry of the bees depart from them: their stores of honey are often undefended and unprotected in such queenless hives, and stolen by the bees of prosperous ones.

THE AGE OF QUEEN BEES.

They live four years. In this fact the worth of their lives to the community is seen. The working bees live but nine months, and the drones are permitted neither to live nor to die; they are destroyed. The climax of their history is a chapter of horrors. But queens, generally speaking, live four years. A few die when they are three years old: scarcely one dies a natural death sooner. It is of great importance to a bee-keeper to know

the age of his queens, but this point will be noticed again in another place.

Queens are fourteen days in being hatched; that is, perfect queens are produced on the fourteenth day after eggs have been put into royal cells. The length of their days is not, to a thoughtful bee-keeper, so great a marvel as the shortness of time in which they are in their cradle-cells. Only fourteen days for the process of developing small eggs into princesses of the blood? Yes, they are perfect in fourteen days. How long is a worker in the cell? Twenty-one days. And a drone? Twenty-four days. It is herein seen that queens are hatched in less time, by one half, than drones. The mystery of this is beyond our depth, but the fact indicates the value of the presence of the queens in their hives. When a queen is accidentally killed, or dies unexpectedly, or is taken from a hive, as in artificial swarming, the bees have the power to make another. They take an egg meant for a worker from a common cell, where, if unmolested and undisturbed, it would be developed into a worker in twenty-one days, and place it in a royal cell, and there convert it into a queen in fourteen days. In the royal cell the egg is developed into a different bee—different in size and colour, perfect every way, and perfect in seven days less time than it otherwise would have been if left in a common worker-cell. This is an exceedingly interesting point in bee-history, and a wise provision of nature. It is a fact established beyond dispute, that bees have the power of rearing queens from common eggs. How do they accomplish this work, and by what means? The power seems to be in a substance termed "royal jelly," which has a milky, gelatinous appearance. Whenever an egg is set in a royal cell, the bees place around it this milky-like substance, in which a little worm or grub

is soon floating, and by which it is fed. What this "royal jelly" is, I do not know—neither can I tell where it comes from. It is understood that no writer has ventured to describe how or where it is manufactured or obtained. It has been said that this substance, which possesses so great and peculiar a power, is more pungent to the taste than that which is used in feeding the young of workers. We have never tasted either. If some analytical chemist would ever like to examine the two substances, with a view to discover the difference, we would gladly furnish him with a thimbleful of jelly in the swarming season—taking it, of course, from the cells in which it may be deposited.

What takes place at the birth of queens will be explained when we come to the chapter on swarming, natural and artificial.

IMPREGNATION OF QUEENS.

This is a very important affair—so important that a bee-keeper should know all he can about it; when and where it takes place, and what happens when it never takes place at all. Very well. Queens are mated or take the drone when they are very young—viz., from two to ten or twelve days old. If they are not mated before they are ten or twelve days old, they are worthless for breeding purposes, worthless for every purpose save that of keeping the bees together till they are worn out by labour or old age.

When we consider the importance of impregnation, the number of drones is not to be wondered at, especially when we consider that copulation never takes place inside a hive. If the weather be unfavourable for ten days after their birth, queens are not mated. Some five-and-twenty years ago I caused a hive to rear a queen in the

month of September, after all the drones had been destroyed. I wanted to know on how many days she left her hive to find a companion. Being a journeyman gardener at the time, I visited the hive but once a-day, generally about four o'clock in the afternoon. The mouth of the hive was shut, so that every bee had to pass through a narrow tube, projecting two or three inches, before it took wing. Though the way out was plain and easy, neither the queen nor bees ever found the way back into the hive. For nine days the queen came through the tube, though the weather was rather cold and showery at the time, and was invariably found sometimes trying to find an entrance into the hive, or nestled up in a small cluster of bees near the door of the hive. Once I saw her come home and light on the flight-board at four o'clock. The sky was heavily clouded, and the atmosphere rather cold. Of course the queen and bees found outside the hive were admitted every afternoon. This simple experiment fully convinced me that the impulses of a young queen for a mate are very strong and urgent; and when she fails to find one, the fault is not hers.

The drones seldom leave their hive but in very fine weather. This fact accounts for the non-impregnation of queens during unfavourable weather. Very cold or stormy weather may, and often does, I daresay, prevent queens from leaving their hives on these errands or occasions of necessity. Failure is very uncommon in fine weather. About the time her majesty is expected to leave her hive, the drones come out in great force and make a tremendous noise in front of the hive. By reason of their number their buzz becomes a roar, heard at a considerable distance from the hive. Last year I happened to hear this well-known sound, and went at once to see her majesty come out of her hive and go away on her marriage-tour.

The hive was no sooner reached than she was seen going into it. She had been abroad before the drones had come out. In about five minutes after her return she came out again, and took wing amid a noisy rabble of drones.

The statements of some authors about queens selecting their lovers in their hives, and then going away together to make their nuptial couches high up in the air, where no eye may follow, are mere poetical fancies. When a queen comes out for this purpose, she comes by herself: she has no favourites—will accept a mate from a strange hive, or from a distance, as readily as from her own hive. How far she will fly in search of a mate is not known. But it is well known that drones fly great distances from home, and often impregnate queens which they happen to meet. Though there were a great many hives in our garden last year, and drones enough in every one of them, some of our young queens were made fruitful by contact with Italian or Ligurian drones. Now, no bee-keeper within a distance of four miles has bees of this kind. This fact shows that pairing inside never takes place.

But where does copulation take place? In the air, or on the ground? Most writers think it takes place in the air. We believe it takes place on the ground—that the queen is caught in the air by the drone, and both come down. Last summer I saw a queen hotly pursued by two drones. She was overtaken, but they did not catch her. As soon as they apparently reached her, she doubled and went back as a hare does when pursued by dogs. She gained a few paces at the turn, and all went out of my sight. When I was a lad, in my father's house, a labouring man called to tell us what he had seen while digging in a field about half a mile from our house. He heard a great noise, as if a swarm were passing over his head; he instantly looked up, when a ball or cluster of drones fell

at his feet, half the size of his spade-handle. He got a bit of stick and began to poke amongst the drones, when to his astonishment a queen crawled out of the cluster and took wing, followed in a twinkling by all the drones. His statement we believed at the time, and still believe it.

A great many queens are lost on their marriage-tours; they never return. Whether they fall into water and are thus lost, or lose their way home, or go into the wrong hives, I cannot say; but most bee-keepers of observation and experience well know that these necessary excursions are not unattended with risk, and sometimes with loss.

It is well for the bee-keeper that his queens, when timely impregnated, never require the drone again as long as they live. They never again leave their hives for this purpose. It is believed that during the first ten days of their lives copulation may take place more than once, but afterwards it never takes place. And this is one of the most extraordinary things in bee-history. A queen bee lives four years; lays a vast number of eggs—at least 2000 a-day—in the heat of summer, for months together, every year. I guess that a healthy fertile queen, during her life, lays *at least* 800,000 eggs—200,000 a-year. Now these eggs are all duly fecundated, and capable of hatching into young bees, though the queen never meets a drone after the first few days of her existence.

EGG-LAYING.

This commences from six to ten days after impregnation takes place. Who can think of the laborious and monotonous life of a queen bee without feeling a little compassion? This queenly creature leads a life of toil. Six months of the year does she move from comb to comb, and from cell to cell, minding her own business. Thus she travels up and down the hive, seeking empty cells in

which to lay her eggs. Her eggs are of some size and substance, in shape somewhat akin to birds' eggs. When she finds a cell empty, she inserts her abdomen and then drops an egg, which adheres to the bottom of the cell by the small end. The eggs come so fast from her that she has neither time nor strength to lay one in each cell: often two and sometimes three drop into one cell. An amateur bee-keeper in this neighbourhood came to see me a few months ago, and said, "I believe all you say about bees but one statement as to the number of eggs laid by a queen. I think it is not possible for a queen to distribute 2000 eggs in twenty-four hours." He was told that the working bees helped to distribute and deposit the eggs in their cells; that where two were laid, the bees removed one and placed it in another cell. He was asked if he ever watched the queen's attendants in a leaf or unicomb hive. He said he had observed how they kept their heads towards her abdomen, and moved around her with the greatest vigilance. He was then told that these attendants nimbly caught the eggs as they came from her body. He at once acknowledged that his doubts were removed, and now understood how the cells were furnished with 2000 eggs daily.

It is always pleasant to meet with honest, intelligent inquirers, men that will not believe a thing without a reason. And what reason have you for saying that a single queen bee lays 2000 eggs every day in the height of the season? A very satisfactory one. We have seen hives containing more than 2000 square inches of combs each. Let us suppose that only half of these combs were filled with brood, and the rest filled with honey and bee-bread: that is 1000 inches of comb for brood in each hive. One inch of comb has fifty worker-cells in it, twenty-five on each side. Very well, 1000 inches of comb con-

tains 50,000 young bees, in all stages, from the egg up. These 50,000 young bees came from one queen in three weeks. Divide the 50,000 by 21, and it will be found that the average number laid per day for three weeks amounts to some hundreds beyond 2000 per day. What prodigious fertility! What generous feeding of the queen is necessary to repair the waste and wear of such fertility! We have not yet seen a hive large enough to overtax the laying powers of a queen bee.

THE SEXES OF EGGS.

Most writers on this subject believe that a healthy and timely-impregnated queen bee lays both male and female eggs—that the male eggs hatch into drones only, and that the female eggs may become either queens or working bees, according to the treatment they receive in their cells. These writers maintain that a queen is a perfect female, and a worker an imperfect one. They hold that the food supplied to the little worm does not alter the sex, but simply develops its organs of reproduction; in other words, makes it a perfect female. In the case of workers, it is said, the same food is not supplied; that though the eggs from which they come are identically the same as those which yield queens, they are fed differently, and hence are born imperfect, with organs undeveloped. It is questioned by some whether the special treatment is given to the young that become perfect and fully developed females, called queens, or to the young that are dwarfed and crippled into workers. The reader is earnestly requested to bear in mind that all enlightened bee-keepers as well as all bee-historians have not a doubt, or the shadow of one, as to the capability of these female eggs becoming either queens or workers. Six-and-twenty years ago I wrote a short treatise on bees which appeared in

the pages of the 'Gardeners' Chronicle' at that time. In that treatise we held that *all* the eggs laid by a perfect pregnant queen were alike, and that the bees have the power, or seem to have it, of producing queens, drones, or working bees from them. The Rev. J. G. Wood, whose book appeared some twelve years later, quotes my language, and adds that "this is a point to which it would be well if scientific men would give renewed attention. All the known facts appear at present to favour Mr Pettigrew's statements."

The question may be asked if nothing has transpired amongst my own bees, during the last twenty-six years, to make me alter that opinion. Nothing has been seen to make me alter the opinion expressed so long ago. Within the last three months, my friend J. W. Woodbury, Esq. of Mount Radford, Exeter, perhaps the most distinguished bee-historian of this age, finding that I intended to produce a work on bees, very kindly and considerately undertook to discuss the matter in hand privately, with the hope that he would thus convince me that the eggs of the honey-bee were not alike, but of different sexes. Mr Woodbury has consented to let me insert in this work his letters on this subject. On perusal they will be considered by all to be the product of a mind honest and enlightened —one that has long been open to the influence of reason, analogy, and investigation. Though I am yet to be convinced that he is correct in all his conclusions on this subject, I wish the reader to know that I set a very high estimate on the opinion of Mr Woodbury on all matters pertaining to the habits of bees.

After inserting his letters we shall quote a few paragraphs from an American author, Mr Quinby, who thinks for himself, and honestly and fairly states what he thinks. Then we shall supplement the whole with a few remarks of our own.

Letter First.

"Mount Radford, Exeter,
22*d Sept.* 1869.

"My dear Mr Pettigrew,—I hold that the eggs of bees when laid are of two sexes, male and female, and that no after-treatment can alter their sex.

"Male eggs invariably hatch into drones whether laid in drone or worker cells, or even when laid in royal cells. Female eggs as invariably hatch into females, either perfect or imperfect—*i.e.*, queens or workers—according to the mode in which they are reared.

"That workers are females is proved by the fact that they sometimes lay eggs, which, however, always hatch into males. That the sex of eggs is unchangeable is demonstrated by the fact that those laid by workers or by certain queens (usually called drone-breeders) can never be developed into females, either perfect or imperfect, by any course of treatment.

"I have often had recourse to the plan you describe by placing drone-combs in the brood-nest, when wanting Italian drones, feeding liberally at the same time, and, if other circumstances were favourable, seldom failed in my object. This, however, only shows that if extraordinary facilities be afforded, the laying of drone eggs may be promoted and increased, not that the sex of eggs is changed.
—Yours ever,

J. W. Woodbury."

The next letter is well written, and is very suggestive and comprehensive. He was requested to confine his remarks to the eggs of healthy timely-impregnated queens, and to remember that drone-breeding queens and fertile workers were abnormal, and therefore not to be discussed in these letters.

Letter Second.

"*Sept.* 30*th*, 1869.

"My dear Mr Pettigrew,—I am far from presuming to teach you, but will simply place facts before you in the light in which they present themselves to me, and must leave you to decide whether they agree with your opinions or with my own.

"In the first place, I must agree to differ from you *in toto* with regard to excluding the eggs laid by virgin queens from consideration. To my mind they throw so much light on the subject that they may really be said to decide the question. These queens lay eggs which certainly are of a fixed sex, for under no circumstances do they hatch into females. Anatomical examination proves the males hatched from them to be perfect in their kind, nor do they differ one iota from the male offspring of fecundated queens. *A priori*, therefore, the conclusion is to my mind inevitable, that, no matter whether laid by perfect queens, drone-breeders, or fertile workers, the eggs which produce males are in all cases identical; and that if the sex be unalterable in some eggs, it must, in the absence of irrefragable evidence to the contrary, be equally so in all. The raising a queen from a worker egg or grub is quite a different matter, consisting as it does merely in the development of organs which would otherwise remain dormant, and not in any respect reversing the sex.

"A 'healthy and timely-impregnated queen' sometimes begins by laying a confused mixture of worker and drone eggs in worker-cells; these all receive their appropriate coverings, causing the surface of the comb to present a curiously uneven surface; after a while this irregularity disappears, and worker-eggs only are laid in the usual manner. I had one queen which, after impregnation,

commenced by laying in a beautifully regular manner—not a single worker among them—some thousands of drone-eggs in worker-cells; they were all reared to maturity, and then cast out by the workers. Now, all these that I have referred to were unquestionably healthy and timely-impregnated queens, which, after the first aberration, continued the fulfilment of their functions in a perfectly regular and satisfactory manner.

"To me the conclusion to be drawn from this appears so logical as to be perfectly irresistible,—that the workers had no control whatever over the sex of the bees. Under your hypothesis they would seem to have indulged the whim of raising some hundreds (or thousands, as the case may be) of drones at a time when they could be of no possible use, only to destroy them as soon as they come to maturity.

"An ample population, abundant food, and the presence of drone-cells, generally dispose a queen to lay drone-eggs; and so far as the apiarian can contribute to this state of things, you are correct in what you say about his being able to *command* the production of drones at a given time. But more than this, with an *old queen* he will *scarcely ever fail* in the attempt; with a young queen of the current year he will *scarcely ever succeed.* This fact, which has been proved over and over again by myself and others, is sufficient to demonstrate that the workers are perfectly unable to determine into which sex eggs shall hatch. If bees had the power of developing eggs, after they were laid, into either males or females at will, the same instinct which impels them to rear perfect females from worker-eggs or young brood, when deprived of their queen, would doubtless lead them, in the absence of drones or drone-brood, to transform the remainder of the worker-eggs which they might possess into drones. I need not tell

you, however, that nothing of the kind ever takes place, and that the absence of this power has doomed many a colony to extinction.—Yours most sincerely,

"J. W. Woodbury."

On the receipt of this last letter, notice was specially made of the fact that when a queen is produced from an egg taken from a worker-cell, something more takes place than the mere development of organs. Mr Woodbury was reminded that a queen is a different bee from a worker—different in form, colour, habit, and lives six times as long as a working bee. He wrote a third letter, part of which will be quoted, as the rest is a repetition of what has gone before.

He says: "The development of queens from worker eggs or grubs is without doubt a most marvellous transformation, but I understand that we are both agreed that it is not a change of sex.

"The well-known singular effects of mutilation of, or injuries to, the reproductive organs in man and in animals, seem, however, to bear some slight analogy to the wonderful development to which you refer. A eunuch has a treble voice and no beard, whilst his hips become more than ordinarily developed, and his limbs assume the roundness of the female form. A woman with diseased ovaries sometimes develops a beard and obtains the bass voice of a man; whilst a hen in a similar condition may assume the plumage and loud crow of the cock. All these instances apply rather to workers than to queens; and it may certainly be said, that in them something more takes place than the repression of organs which would otherwise have been developed. The individuals affected may in fact be pronounced quite different from others of their kind; but the marvel would, I think, become an actual

miracle if there were a positive reversal of sex. It seems to me also that the prolongation of life in the queen bee may not be the *direct* consequence of the full development of her sex, but may arise from it in a *secondary* manner—viz., from her exemption from outdoor labour. Worker-bees, when confined to the hive during winter, live five or six times as long as in the summer; and it appears, therefore, not improbable that, if proper means were adopted, the lives of fertile workers, which, I believe, never leave home, might be prolonged until they equalled those of queens."

From the same letter I will make one more short quotation. Mr W. says: "A young and prolific queen of the current year, in the full flow of working egg-laying, can scarcely be induced, under any circumstances, to deposit drone-eggs, but year by year she gets to lay them with greater and ever-increasing facility, till in extreme old age she may become incapable of laying any others. To my poor comprehension it seems perfectly impossible to reconcile these facts with your theory, that her eggs are throughout all of one kind, convertible by the workers into either sex."

Mr Woodbury's last letter of this correspondence goes deeper into the subject than any of the former ones. It grapples with the physiology of the question. The reader, it is believed, will be greatly interested in perusing the following quotation:—

"The ovaries of a queen bee are never impregnated, the semen being stored in a distinct vesicle called the spermatheca, a portion of the contents of which is either communicated to, or withheld from, every egg as it passes through the oviduct—and this difference determines the sex. Every egg which received a portion of the contents of the spermatheca becomes a female, either perfect or imperfect; every egg which passes unfecundated can hatch

only into a male. Drone-breeding queens are virgin queens, which can, of course, lay only unfecundated eggs, and whose eggs must therefore always hatch into males. Old queens, when the contents of their spermatheca become exhausted, may, and sometimes do, return to the drone-laying condition of virgins. These are not mere theories, but *absolute facts*, which have been abundantly demonstrated by anatomical and microscopical investigations. I can speak with perfect certainty on the point, as I happen to be the first Englishman who has been enabled to repeat and verify these investigations.

"I cannot tell why unfecundated ova in bees should always produce males: I only know that it is so."

Mr M. Quinby's book is remarkable for this, that, unlike most others on bees, it is not a mere compilation from various authors. He is an *open-eyed* bee-keeper of great experience, and a vigorous thinker, who can take nothing for granted. Somewhere in his book he shrewdly remarks that *his* bees do not behave like those of other people—meaning thereby that his experience is at variance with many writers. Though I cannot say Amen to some things advanced by Mr Quinby, I have great pleasure in stating that his book is the result of his own researches, and is, in my opinion, calculated to remove foolish notions from the minds of those who do not think for themselves.

At page 80 of his 'Mysteries of Bee-Keeping' Mr Quinby says: "I am not anxious to establish a new theory, but to get at facts. If we pretend to understand natural history, it is important that we have it correct; and if we do not understand, say so, and leave it open for further investigation. It is my opinion that we *know* very little about this point. I wish to induce closer observation, and would recommend no *positive* decision until all the facts that will apply have been examined. Theories differ-

ing materially are advanced by nearly all writers. One says, 'In spring the queen lays about 2000 eggs of males, resumes it in August, but during the interval lays exclusively worker-eggs.' Another writer repeats the same, and states that he has found out that the eggs for the two kinds of bees are germinated separately, and the queen knows when each kind is ready, as well as the workers, &c. Now I beg leave to differ a little from these authors. Either there exists no difference in the eggs germinated, and any or all will produce drones or workers, just as they happen to be deposited and fed; or else the periods of laying drone-eggs are much more frequent than any writer with whom I am acquainted has been willing to allow. Whether these drone-egg theories have been too hastily adopted, the reader can decide: I shall offer a few more facts, somewhat difficult to reconcile with them. The following circumstance would appear to indicate that all the eggs are alike; and if they are laid in drone-cells, the bees give the proper food, and make drones—if in worker-cells, workers, just as they make a queen from a worker-egg when put in a royal cell.

"In a glass hive, one sheet of comb next the glass, and parallel with it, was full size; about three quarters of this sheet was worker-cells, the remainder drone-cells. In about the middle of June 1850, I discovered on this outside sheet the bees preparing it for brood, by cutting off the cells to their proper length. In a day or two after, I saw a few eggs in both worker and drone cells; four or five days afterwards, on opening the door, her 'majesty' was engaged in depositing eggs in the drone-cells. Nearly every one contained an egg; most of these she examined, but did not use them; six or eight were all that were unoccupied—in each of these she immediately deposited an egg. She continued to search for empty cells, and in

doing so she got on the part of the comb containing worker-cells, where she found a dozen or more empty, in each of which she laid one. The whole time, perhaps thirty minutes. Query, Was her series of drone-eggs exhausted just at this time? If so, it would appear that she was not aware of it, because she examined several drone-cells, after laying the last one there, before leaving that part of the comb, and acted exactly as if she would have used them had they not been preoccupied."

"If food and treatment would create or produce organs of generation in the female, by making an egg destined for a worker into a queen (a fact which all apiarians admit), why not food and treatment make the drone? Is the difficulty of developing one kind of sexual organs greater than another?"

"Other animals or insects usually produce the sexes promiscuously. As we are ignorant of the causes deciding sex in any case, we must acknowledge mystery to belong to both sides of the question. The stumbling-block of more than two sexes which seems so necessary to make plain, is no greater here than with some species of ants, that have, as we are told, king, queen, soldier, and labourer —four distinct and different-formed bodies, all belonging to one nest, and descended from one mother. Whether they are four distinct kinds of eggs producing them, or the power is given to the worker to develop such as are wanted from one kind, we cannot say. If we make two kinds of eggs only, it helps the matter but little. There is still an anomaly."

"I shall leave this matter for the present, hoping that something conclusive may occur in the course of my experiments or those of others. At present I am inclined to think that the eggs are all alike, but am not fully satisfied."

The reader has in these quotations the opinions of two advanced bee-historians on the question before us. Observation, extending over many years, has not led Mr Quinby and myself to the conclusions arrived at by Mr Woodbury, who considers the evidences and facts which he has adduced quite sufficient to convince any reasonable mind that the eggs of a queen bee are, when laid, of a fixed sex, unalterable in that respect.

Having held the opinion that all the eggs of a queen bee, in proper condition, are of one kind only, and convertible into queens, males, or workers, for so many years, it becomes us to give our reasons for holding to the same opinion still. Supposing the eggs are of different sexes, we are yet to be convinced,—

I. That queen bees know what kind they are about to lay. If Mr Woodbury's conclusions are correct, they do know this, and lay male eggs in drone-cells, and female eggs in worker-cells. The reader, of course, will use his own reason in settling this "knotty point" to his own satisfaction. Has a queen bee more power than a bird, or beast, or human being, in the generation of offspring, to determine and fix the gender before her eggs are dropped into cells? Can she *will* to lay 1000 male eggs to-day, and 1000 female eggs to-morrow? Or has she no more power to destine gender otherwise than may occur in human generation?

If the queen cannot will and fix the sex of eggs before they are laid, do the working bees know any difference between male and female eggs after they are laid? If neither the queen nor workers can distinguish the male from the female eggs—*i.e.*, those that are not fecundated from those that are—how comes it to pass that male eggs are deposited in drone-cells, and female eggs in worker-cells? Till the knowledge of the difference of male and

female eggs be established, and the law of their distribution explained, it seems a very difficult matter to believe in any difference at all.

Let us suppose that we have six hives, three of which have scarcely a drone-cell in them; the other three are half filled with drone-combs. Those filled with worker-cells will be filled with worker-brood; and to the same extent will the three with drone-cells be filled with young brood, but the half of it will be drone-brood. Three of the hives will have very few drones, the other three will be half filled with them. If the three queens which have been depositing eggs in the hives containing worker-combs exclusively, and thus producing nothing but working bees, were exchanged for, and put in the places of the queens in the hives containing the drone-combs, we would find that their progeny, like the other queens, would be half male and half worker. If this experiment were repeated a hundred times, in various ways, the result would be the same—viz., the number of cells determining the number of drones bred. The bee-keeper can *command* his bees to breed drones, simply by placing empty drone-comb in the queen's way while laying eggs. If a hive have drone-comb near the centre, where the queen commences to lay her eggs in early spring, drones will be produced in it much sooner—a month or six weeks sooner—than in those whose drone-combs are built on the outsides of the combs. Mr Woodbury admits that he rarely fails to get drones by placing a bit of empty drone-comb in the midst of the nest sooner than usual.

Again, in strong hives, drones are produced four, six, or eight weeks earlier than in weak ones. If the queens of the weak hives were transplanted into the strong ones, we should find drones produced as plentifully from their eggs, as from those whose places they fill. And, more-

over, if the queens from the strong hives were placed in the weak ones, their eggs become exclusively workers. Admitting that there are difficulties on both sides of this question, the reader will naturally, like electricity or running water, follow the line of *least resistance*. Where there is room left for guessing—where conclusions are not yet fully demonstrated—it ill becomes us to speak in positive terms.

Mr Woodbury honestly thinks that the results of his investigations have placed the matter absolutely beyond a doubt. For above thirty years I have not had a doubt as to the convertibility of eggs into queens, drones, or workers. But as this question is interesting alike to the student of physiological science and to the intelligent bee-keeper, we shall, if all be well, probably put the question to the test of searching experiments.

When I was lately in Scotland, I was informed of two instances of drone-comb containing eggs being placed in queenless hives. From these eggs the bees *manufactured* queens for themselves. This test or experiment may be easily tried; and, if fairly and fully tried, will put the matter beyond a doubt. It is an easy matter to take a queen from a hive, and, five or six days after that is done, to cut out every royal cell containing a young queen. In twenty-four or forty-eight hours afterwards, a bit of drone-comb, with fresh-laid eggs in it, could be cut from another hive, and fixed in the hive thus robbed of its queen and royal cells. If the eggs are all of one gender when laid, the bees will manufacture queens from the eggs thus transplanted. If the eggs are male, as Mr Woodbury and others say they are, the bees must be unable to rear queens from them. No experiment can be more simple or satisfactory than the one now suggested. If the bees fail to rear queens from such eggs, we shall be most ready

to acknowledge the mistake we have made all our life long.

The same test could be applied to hives that have swarmed. Four or five days after the first swarms have left, cut out the royal cells, and transplant a few eggs in drone-cells as described above. This experiment is within the reach of very inexperienced persons, and it is hoped that in a short time all doubt and scepticism will be removed.

But the reader may say that Mr Woodbury has not the shadow of a doubt on his mind that eggs are of different sexes, male and female.

I had intended to examine minutely every paragraph of Mr Woodbury's letters, but as we are anxious to bring this chapter to a conclusion, we shall notice only a few of them.

Mr W. says,—"A young and prolific queen of the current year, in the full flow of worker-egg laying, can scarcely be induced, under any circumstances, to deposit drone-eggs; but year by year she gets to lay them with greater facility, till in extreme old age she may become incapable of laying any others. To my poor comprehension, it seems perfectly impossible to reconcile these facts with your theory, that her eggs are throughout all of one kind." Stop a little. We have known *many* queens die of old age, but their eggs till the last were capable of being hatched into either males or females. When a queen dies of old age in the breeding season—and queens generally die then—the bees almost invariably set a considerable number of eggs in royal cells, and these hatch into females. It is not a fact in our experience that the eggs of a queen, timely impregnated, ever become incapable of hatching into workers and queens.

Take another statement of Mr W. "The ovaries of a

queen bee are never impregnated, the male semen being stored in a distinct vesicle called the spermatheca, a portion of the contents of which is either withheld from, or communicated to, every egg as it passes through the oviduct, and this difference determines the sex." If this is true, it appears to us all but impossible to account for the fact that impregnation makes a queen prolific ; that is to say, causes her to lay ten times—nay, fifty times—more eggs than a queen unimpregnated.

If the impregnating matter is simply lodged in a distinct vesicle—not affecting the laying or productive powers of a queen, but merely touches and femalises so many eggs in passing through the oviduct—how comes it to pass that unmated queens are nearly barren? Here is an insurmountable barrier or difficulty in the way to Mr Woodbury's conclusions.

Difficulties as insurmountable rise up before the mind when it thinks of the mere *will* of the queen determining which eggs shall be laid male and which female in character. And by what muscles, voluntary or involuntary, in the body of the queen, does she effect the fecundation? Mr Woodbury believes in both the *will* of the queen and the apparatus by which she carries it into execution in the fecundation of her own eggs. We are slow to follow him.

It is well known that a queen lives four years, and a common worker nine months. It was stated to Mr Woodbury that the mere development of her sex could not prolong the life of a queen. He replies in these words : "It seems to me also that the prolongation of the life of a queen bee may not be the direct consequence of the full development of her sex, but may arise from it in a secondary manner—viz., from her exemption from outdoor labour." Most people would think that the absence of

outdoor exercise would weaken her constitution and shorten her days, considering the fact that her indoor life is one of toil and drudgery. The story of the eunuch, and the woman with the beard, and the loud crow of the hen, is very beautiful, and indicates great breadth and ingenuity; but who will admit that it touches the difference between nine months and four years? The eunuch, the woman, and the crowing hen may live as long as any of their kind; but a queen bee lives six times longer than a worker, and yet she is said to be a perfect female, and a worker an imperfect one. To my mind they are both perfect, but very different, bees.

Mr Woodbury says,—"An ample population, abundant food, and the presence of drone-cells, generally *dispose* a queen to lay drone-eggs." We should say, these dispose the bees to set eggs in drone-cells, and administer their appropriate food.

But this long and tedious discussion will not help us much in our search for the most profitable mode of bee management. Let us conclude in the language of Mr Quinby—viz., "We are inclined to think that the eggs of a queen bee are all alike, but are not fully satisfied."

CHAPTER II.

DRONES OR MALES.

These are about the most idle and unfortunate creatures in existence. They are generally hatched in drone-combs; that is to say, in cells larger, considerably larger, than those of common workers. These large cells, built up together, are called drone-comb. The less drone-comb there is in a hive, the better it is for breeding purposes; for though the bees can rear drones in worker-cells, they never rear workers in drone-cells. When a hive has much drone-comb in it, there will be produced a superabundance of idle fellows, which will consume a great deal of honey. Drone-combs are generally situated on the extreme outsides of the worker-combs, but sometimes they are found near the centre of the hive. It is the position and number of drone-cells in a hive that determines the number of drones reared. If such cells are near the centre, drones will put in an appearance long before the hive is ready for swarming; and if on the outside of the combs, the hive will be ready for swarming about the time drones are first hatched. The appearance of drones is therefore no safe guide as to the ripeness of a hive for swarming.

The drones are twenty-four days in being hatched from eggs; that is, they come to perfection in twenty-four days, being three days longer in their cells than workers, and ten days longer than queens.

But why so many idle fellows in a community remarkable for industry and activity?

It is easier to ask the question than to answer it. They are produced for a purpose, and that is the impregnation of queens. When the importance of this impregnation is considered, the apparent want of economy in the production of so many otherwise useless creatures will not be wondered at. The time given for this impregnation is very limited—ten or twelve days at most. When weather is cold or wet, drones do not leave their hives; and even when the weather is fair and favourable, they do not all leave their hives at the same time. As the reader is already aware that copulation takes place outdoors—it may be at some distance from the hive—he will see at once why so many drones are usually produced. Better to have a superabundance of 10,000 drones than the queen fail to meet one. The more drones in a hive—indeed, the more hives in a garden—when a queen becomes marriageable, the more likely is she to be seen and mated when she leaves on that errand.

Queens and drones, the product of one mother, mate without the least deterioration of blood. In-and-in breeding amongst bees for generations and ages does not in the smallest degree produce bad results.

The great characteristic of a drone bee is his laziness. He will die of want rather than work. Drones have never been known to do "a hand's turn." In fact it is a question whether they feed themselves in the midst of plenty. We daresay they do sometimes; but how frequently are they to be seen stooping down to be fed by the working bees! If the reader has seen young sparrows or pigeons fed by the old ones, he will be able to form a pretty correct idea as to the way in which the working bees pump honey out of their bags into those of the drones.

Drones wanting to be fed place their feeding-tubes alongside of those of workers, and thus remain apparently motionless while the pumping process goes on.

But these idle gentlemen know the country geographically better than the working community. In fine weather they take longer excursions into the country for pleasure than working bees do for food. If a hive be removed in fine weather two miles, some few bees and a great many drones return to the old place. If removed three or four miles, a considerable number of drones return, but no workers. Drones have been known to return five miles.

Comparatively useless in their lives, drones come to a sorrowful end. What is termed the massacre of drones is a strangely cruel process: they are starved to death. Well might a great naturalist, and a friend of the writer, exclaim,—"The climax of drone-life is wonderful—a chapter of horrors, which clouds the harmony of an otherwise beautiful system of insect-life."

About fourteen days after the queen of a hive has been impregnated, or some days after she has begun to lay, the working bees begin to haul and maul the drones about. Day by day the bees seem more anxious to worry the drones, and feign to sting them, but seldom use their stings. Inside the hive the drones are driven from the honeycombs, and may be found in heaps on the board for days. Here they become weak from want; and when they leave their hive many of them have savage tormentors on their backs. Some fall off the flight-board so weak that they cannot fly; but most die at a distance, being unable to return.

Some drones go with the first swarm, but as they are not wanted there they are soon destroyed. But as the hives of these first swarms become full of combs and bees, drone-cells are built, and preparations for swarming are

made as in the old hive in spring. Soon the first swarm will be as full, and contain probably as many drones as the mother hive did when on the eve of swarming. If this swarm be kept full and prosperous, drones may be continuously reared till the end of the season, when the general massacre takes place. But often the lives of drones and drone-brood are destroyed during weather unfavourable for gathering honey. On the appearance or prospect of hard times the bees destroy these comparatively useless creatures and cast them out of their hives. Whenever white drones are seen being cast out, the owner may be pretty certain that his bees are on the border-land of starvation. The lives of drones being always cut short, no one can say how long they would live if let alone.

CHAPTER III.

THE WORKING BEES.

The common working bees are twenty-one days in their cells, and live nine months. Probably nine-tenths of them die, from some cause or another, before they have reached their alloted span; but at the end of nine months or thereabouts, after their birth, all perish. The working bees are considerably smaller than either queens or drones. They do all the work and drudgery of the hive, and do it with a willingness and activity that beggar description. They manufacture the wax, build the combs, gather honey by day, and store it away by night. It is hard to believe that they never sleep, though we have never seen one either sleepy or asleep, in summer or winter.

Put a swarm into an empty hive; in less than an hour the working bees commence to clean it out. Speedily the foundation of a great and wonderful city is laid. Great Bee! some one has said, that steps forth to lay the first stone of a city that can never be excelled for architectural beauty and order—a city of wax, in which may be born yearly 300,000 beings—brave loyal citizens!

For industry, ingenuity, and courage the working bees stand very high.

THE INDUSTRY OF BEES.

How few bee-keepers know the worth of their own stock—the value of their own servants! No writer can

get near enough to touch the hem of the garment of the industry of honey-bees. It is beyond our comprehension or description. Fancy a large and prosperous hive, full of combs, bees, and brood; fancy 20,000 little grubs in this hive requiring constant attention and proper food, and all receiving them in due season; fancy the care and diligence of the bees in mixing and kneading this food before they give it to their young; fancy 2000 of these grubs daily requiring and receiving beautiful lids on their cells to cover them up while they pass into the insect form and chrysalis state; fancy 800 or 1000 square inches of this brood being built up every three weeks. Try these combs in the scales against a twenty-eight-pound weight and see which conquers. Stand and look at that bee-hive, and remember that all therein goes on with unerring exactness and without light: then think of the untiring energy and perseverance of the bees outside the hive—ranging fields and woods from morn till dewy night, gathering up the sweets and pollen of flowers, storing the one in sacks, the other in baskets, returning to their home laden as donkeys with panniers, increasing their honey stores in weight from 2 lb. to 6 lb. per day, securely locked up after it has been twice swallowed and disgorged, and thus made into honey proper. Yes; think of all these things being done, together with nameless and countless offices performed every hour, and methinks you will be dumb with amazement at the industry of these wonderful bees!! What a world of wonders is in a bee-hive! Bonny wee bees! your own fanning wings will drive from your hives scores of tons of the sweat of your labours ere the imagination of the poet or the pen of the historian can compass your industry!

Without any pretension to accuracy, and anxious to be

within the facts, we may say that the daily consumption and waste of a large and prosperous hive of bees in the summer-time is more than 2 lb. To repair this waste, upwards of 2 lb. of materials have to be collected every day. Beyond this there is often accumulated honey to the amount of 4 lb. and 6 lb. daily in favourable weather. Once — but only once — have we known 20 lb. weight gained by one hive in two days.

THE INGENUITY OF BEES.

This subject also defies description. To mention half the instances of ingenuity seen in a large apiary would fill a book. In the building of combs and formation of cells, design is strikingly evident. Honey-cells are made to *dip* to the bottom. If a piece of guide-comb is put in wrong side up, the bees adopt it as a commencement, but reverse the dip of the cells, so as to make them better shaped for holding honey. The stays and props so frequently given to weak places and loose combs display great ingenuity.

When a swarm is put into an empty hive which it can only half fill, the bees, on commencing work, find that the way to the door by the sides of the hive is round about, and to shorten the way to the door they let down two or three beautiful *bee-ropes*, on which to descend and ascend. These ropes are made by one bee suspending itself to another, each bee coming lower down till the board is reached.

In large hives, three of these ladders are let down and used; and in small hives, only one. It is exceedingly interesting to watch the bees which form and compose these ladders. They remain motionless, allowing those

going out and in to ascend and descend with sure and speedy steps.

In the spring months bees are anxious to hatch as many young bees as possible, and therefore spread themselves out as widely as they can. In this way they cover more eggs. Sometimes the weather suddenly becomes cold, causing the bees to have some fears about the brood being chilled. How do the bees then act to protect the brood—or, in other words, to keep up the warmth of the hive? In the most orderly manner they gather themselves into a cluster at the door of the hive, and thus prevent the cold from going in; or, as our more accurate scientific friends would say, keep the heat in. The wisdom of closing their doors in cold weather during the breeding season, and the manner in which the bees do it, ever command the admiration of the thoughtful observant bee-master. Often is the door so closely wedged up—so nicely corked—by these clusters, that there is just room left for one bee to go out and in. On the return of warm weather these protecting "sandbags" are removed.

The story of the dead snail in a bee-hive is worth mentioning. Snails are very fond of honey, and often take lodgings for months, in the winter, inside a bee-hive. They eat both honey and wax. Bees attack and drive out of their hives every enemy but snails and worms. These they will not touch. It happened that a snail died in one. It was more unpleasant to the bees after death than before, but they could not cast it out. Their ingenuity was set to work, resulting in a coffin of wax being built around the snail. If my memory serves me well, an instance of this happened in one of my father's hives when I was young—some fifty years ago.

Once we put a queen nearly dead on the flight-board of

a queenless hive. As soon as she was discovered, the bees came out in a continual stream for some time, heaping themselves upon her to keep her warm and restore animation. This they accomplished in a short time, and safely guided her into the hive.

The ingenuity of bees is strikingly evident when they are at work on a windy day. In calm weather they fly straight on their journeys to and from the fields; but when the wind is high, they seek the shelter of houses, banks, and fences. Often have we seen them flying at great speed along open drains and ditches, and in this way escaping the violence of the wind. And when it becomes necessary for them to leave their sheltered course, they rise like a rocket, and dive again into the most sheltered way. Last August, I placed twenty-five hives near a cutting on one of our lines of railway. On a windy day the bees used this sheltered part pretty freely—indeed so freely that one of the guards told the station-master that he had just passed a swarm of bees going down the line.

THE COURAGE OF BEES.

Cowardice is not an element of their nature; they fear no foe and shrink from no danger. Being furnished with weapons of defence, they know how to use them. I say defence, for that is the proper word. When bees attack anybody or anything, it is owing to some molestation received in act or appearance. The bees of hives placed near a peopled thoroughfare, or in a garden in which men, women, and children are often moving about, become as quiet and peaceable as cocks and hens. They are really domesticated, and will not annoy us if we do not annoy

them. Human breath and sweat are very offensive to bees, and hence it is not wise to move much amongst them while in a state of perspiration.

But what about vicious bees and their courageous attacks? All bees born away from the haunts of human beings, are apt to attack people going near their hives. Away from their own hives they do not attack anybody or anything; but on seeing strangers approach their hives, they anticipate molestation, and are not slow to use their weapons of defence. Again and again have we proven that bees once domesticated never become vicious. Bees that are quiet and peaceable in autumn, are quiet and peaceable in spring, though they may not have seen anybody near their hives all winter. But bees that are born and fly about in lonely places will fearlessly attack either men or beasts that go too near their hives.

HOW TO TAME AND DOMESTICATE VICIOUS BEES.

This is done by making them accustomed to the sight and form of human beings. A scarecrow or two (what the Scotch folk call potato bogies or bogles), placed in front of their hives, soon makes them all right. The scarecrows can be shifted from one position to another a few times. Some years ago I bought a hive in the country and placed it amongst some others at home. The bees would not let me go near their hive. A bogle was placed in front of it, and to me it was interesting to watch the attack: one or two of the savage creatures were seen eyeing the face, and looking for a tender spot on which to dart. In a few days they became as quiet as the rest.

We have been told that a vicious, kicking horse is cured by hanging a bag of hay at his heels in the stall. It is tit for tat; the more he kicks the bag the more it molests him, till his strength is exhausted. His vice leaves him, and the hostler is allowed to do as he likes, and the bag to dangle at his heels. The bee-keeper may place a provoking handkerchief or two in the hands of the scarecrow.

HAVE BEES A LANGUAGE?

To be sure they have. Who has not seen a flock of rooks or crows feeding quietly in a green or ploughed field rise on wing as a black cloud, in the twinkling of an eye, on hearing the watchword sounded by a single bird, which has seen apparent or possible danger near? So bees have a language well understood by themselves; and, we might venture to say, pretty well known by bee-keepers of extensive experience.

There is the hum of contentment and the hum of trouble —the hum of peace and the hum of war—the hum of attack and the hum of defence—the hum of plenty and the buzz of starvation—the hum of joy and the roar of grief—the cry of pain and the music of their winter's sunshine-dance—the buzz of the heavy-laden and the scream of suffocation.

Where is the bee-keeper who is not acquainted with the sound of bees *bent on mischief?* They have not stung him, but he knows they mean it. Sometimes we have been wishful to let the bees of a weak hive have the honey of some combs half empty. When no bees were at work outside, a morsel of comb has been taken to the door of this weak hive; and as soon as four or six bees

began to feed on it, they were carried quietly to the combs to be emptied. As soon as these few bees got home with their booty, the whole hive seemed to be made aware that there was more to be had, and hundreds, nay thousands, were soon busily carrying it home. Bees, then, have a language.

CHAPTER IV.

LIGURIAN OR ITALIAN BEES.

As our object in writing this book is to guide inexperienced bee-keepers in a safe and profitable course, we may be expected to say a few words about Ligurian bees, which were introduced into this country some years ago.

The principle of novelty is implanted in the human mind, and the weakest part of an Englishman is his gullibility. A new style of dress, a Cochin-China fowl, a Ligurian bee, if well puffed and advertised, will command lots of customers. People go mad for novelties. If anybody were bold enough to advertise that he would swallow his own foot at the Free-Trade Hall, the half of Manchester would go to see him; and the house would be filled two hours before the time.

But do you mean to say that the Ligurian sort of bees, which is so much praised and talked about, and sold at such high prices, is not better than the common English sort? Better for what? Do they fly faster? No. Do they carry heavier loads? No. Do they lay more eggs? No. Do their eggs become perfect bees sooner? No. Are they not earlier astir in the morning? No. Do they work later at night? No. Don't they gather more honey? No. Nor breed faster? No. Nor swarm more? No. But are they not better in any sense? No. But are they not prettier then? I think they are, rather;

but a wasp is prettier than either. Why then give £5 or £6 for a swarm of Ligurians? We cannot answer this question. If a gentleman sets his heart on possessing a stock of such bees, let him have it by all means. The gratification and satisfaction arising therefrom may be more than an ample return for all the money he paid for it. At first these bees were by some honestly considered superior to our common bees. The reader will, we hope, see that our object in making these remarks is to guard him against representations that might mislead him, that might induce him to pay a large sum for Ligurian bees, which are not a whit better than those he may already possess.

CHAPTER V.

THE GOVERNMENT OF A HIVE.

M. LAMARTINE once said that "England is a great republic, with a monarchical frontispiece." Using his language, we say a hive of bees is a great republic, with a monarchical frontispiece. The political system of bees is admirable, and perhaps the best that can be adopted by any country or community of human beings.

The queen bee is monarch of the hive; and every hive of bees must have a queen reigning, or in prospect, that is, in embryo. If they have not, their loyalty and activity leave them; they soon become worthless. The monarchy of a bee-hive is a very limited one; for the presence of the queen amongst the bees or in the hive is all the authority she wields; but that is enough to secure the greatest order, contentment, and activity. Deprive a hive of its queen, and we presently find the bees thrown into a state of chaos and commotion, tumultuous to a degree. Let her be restored to them, and there is presently a great calm, and evident tokens of joy and satisfaction.

The queen is called monarch, but she does not rule and govern. The *wee* workers are the governors, rulers over both queen and drones. The harmony of a hive is so great and unique, that it is but seldom necessary for the bees to exercise their great ability, or call into play their mastership. When queens become old and enfeebled, *their* governors

resolve to have younger queens. Royal cells are prepared, eggs are set in them, and then comes the dethronement of the old ones. Frequently these old queens are cast out alive. I have known one such crawl back into the hive four or five times. It was a sad end; but the bees mercifully abstained from hurting her. The welfare of the community demanded her removal, and a worthy successor in her place. Hence they cast her out, and reared another. If they had let her die a natural death, it might have taken place when there were no eggs in the hive, and thus doomed the whole colony to extinction.

In times of threatened poverty and starvation, a queen may lay many eggs, but the bees often wisely remove them, rather than consume the little food left for themselves in rearing brood. Frequently brood, half hatched, is torn out of the cells and cast out of the hives by the will of the workers. Commands are often given *not to swarm*, after arrangements have been made for swarming. When we come to speak of swarming, and explain the same, it will be seen that it is by the will and authority of the working bees that it does or does not happen—weather not interfering.

CHAPTER VI.

SWARMING.

It is our intention to explain this more fully when we come to the practical part of this work. Though it is one of the most interesting parts of bee-history, swarming and all its adjuncts are very difficult to explain, or put in a tangible form. The building of drone-combs, and the formation of royal cells, long before they are wanted, indicate that swarming is a law amongst bees—it is an instinct of their being, and tends to their preservation.

In spring months hives have not very much honey in them. The combs afford plenty of scope for hatching brood; and young bees are born much faster than they die. Hives soon become "choke-full." Sometimes clusters of bees, like bunches of grapes, hang outside. They are ready to swarm. Preparations are made for the important event. The bees well know, long before it comes to pass, that the queen (call her the old or mother queen) goes with the first swarm from every hive. What about a successor to the throne? When the swarm shall have gone, there will be no queen in the hive, no fresh-laid eggs. These wonderful creatures know all this, and therefore never fail to set eggs in royal cells, and thus have young queens *on the way* when they send off a colony. Generally the eggs for young queens are set about four days before swarming takes place. Inclement weather

may prevent the swarm leaving at the usual time; and therefore the young queens may be nearly ripe, and ready to leave their cells, ere the old queen, with the swarm, leaves the hive. Sometimes these young queens are torn out of their cells, by reason of wet or cold weather; and when this takes place, swarming is postponed for a week or two. The weather may become more favourable, and a second time preparations be made for swarming. As the time draws near, the bees send out scouts to find a place for the swarm to go to. Like a queen-wasp in spring, seeking a place to build her nest, these scouts go from bush to bush, up and down the hedgerows, in their own locality. When the spot is fixed on, there is, in some way or other, a consultation about it in the hive, for messengers are seen going straight to and from the place some short time before the swarm leaves. It may, and sometimes does, happen that two places may be selected, half the swarm going to the one, and half to the other.

But let us return to the hive, and we shall find something to excite our admiration. Thirty or forty thousand bees are about to leave the place of their birth, and the comforts of home, never to return. Home-sickness is unknown to emigrant bees, provided they have a queen amongst them. The signal for departure will soon be given, but not before these thirty or forty thousand bees have well filled their bags with honey. Which *great bee* gives the signal to go will never be told, but unquestionably a signal is given, for in a moment the swarm gushes pell-mell, like a flowing stream, out of the hive! What an interesting sight! Talk about the Pilgrim Fathers (and all honour to them) leaving their native land for the shores of America! Look at these courageous bees in the act of swarming, rushing forth to make the air ring with their cheers, rising into the air above us, and there roaring

at the fullest pitch of joy and gladness; and, by reason of their numbers, flying in all directions, giving us all the shapes and forms of a thousand kaleidoscopes. The swarming of bees is like a wedding, or the tally-ho of the huntsman, in this particular, that it seems to inspire all spectators with a felt interest and enthusiasm in the scene. Brave colonists! go and prosper, and multiply exceedingly!

Let us look into the mother hive. Why so quiet now? No suffocation, no crowding, scarcely a sound is heard. More than half the bees have gone; still there are enough left to rear and hatch the brood. Comparatively few hands can be spared to gather honey now; but great numbers are born daily—the brood becomes population. There are no fresh eggs, or queen to lay them. In a short time many cells will be empty, and an ample population, all but free from the duties of nursing, ready and willing to fill them with honey. In this transition state, while the brood is passing into insect forms and living bees, there is great loss of weight. If the weight of honey gathered during the first three weeks after swarming is equal to the loss sustained in hatching the brood, we reckon that the bees have done exceedingly well. But what about second swarms? Well, we had intended to look into the hive after the swarm had departed. We turn it up, and find three, four, or five royal cells have little maggots in them, floating or lying in a white substance like milk. That milky substance is royal jelly—where the bees get it no one knows. Those little maggots will grow uncommonly fast, and be beautiful princesses in ten days. If there is ever anything like a regency in a bee-hive it is now, for there is no queen reigning, no queen born—still all goes on well.

By-and-by there are strange sounds made in that hive. They come from a royal cell. One of the princesses has

come to maturity, and intimates her intention to claim the queendom of the hive. She calls "Off, off, off," which sounds like the barking of a dog at a distance. These sounds she repeats several times; and, being unanswered, she leaves her cell, and becomes the rightful sovereign of the hive. She commences to speak in another tongue altogether. The sounds she utters are now shrill and sharp: she calls, "Peep, peep, peep," or rather, "Pa-ay, pa-ay, pa-ay," eight or ten times. The other young princesses come to maturity, and commence to bark "Off, off, off," in their cells. This barking provokes the reigning queen very much. With murderous intent she runs up and down the hive to find these barking queens. Again and again, every few minutes, is she heard calling, "Pa-ay, pa-ay, pa-ay," sometimes in one part of the hive and sometimes in another. And the responses, "Off, off, off," come regularly from the cells of her sisters. This calling of the queens is termed "piping." What is it for? Who can tell? It goes on for three days and three nights. The reigning queen during these three days is seeking an opportunity of killing her rivals, but the working bees ward off her attempts to get at the young queens; and they too are securely watched and kept in their cells. If the weather be favourable on the fourth day after the calling began, a second swarm will issue from the hive, taking with it the queen which called "Peep, peep." What happens in the old hive? One of the princesses which had been kept confined to her cell for three days is permitted to take the place of her sister. She in her turn calls "Pa-ay, pa-ay;" and if the responsive bark of "Off, off" is continued, a third swarm may be expected on the following day, or, at latest, the day after that.

Third and fourth swarms have been known to issue from a hive in one day. Third and fourth swarms are not very common; for the bees find that two swarms in a

fortnight are enough to send off; and sometimes they can't afford to do that. And to prevent second swarms leaving, the bees adopt signal measures. As soon as the first princess is born, and commences to call or "pipe," they *hush* her into silence at once. Before she gets the one "pa-ay" half uttered, the bees prevent her from going on with it. In stopping her, they make a sound like the word "*hush*" spoken by the human voice. The supernumerary princesses are killed and cast out of the hive.

It has been said that the usual time of piping for second swarms is three days and nights; but it ought to be stated that when the weather prevents swarming, and the bees are bent on swarming, the piping will be continued for some days longer. I have known it continued for seven days; and during those seven days, not one of the princesses ever closed an eye in sleep. The piping of queens, and their deadly and undying hatred of one another, are extraordinary things in the history of bees. Two old queens, or two young ones, it matters not whether they be mother and offspring, or sisters of the blood, or strangers every way, will, on meeting, rush savagely at each other, and fight with greater fury than bull-dogs.

In every contest between two queens it is death or victory. In some such contests both die. I have known two engaged in this deadly and violent struggle roll out at the door of the hive, over the flight-board, and fight it out on the ground. In this battle the one was killed and the other wounded. Once we saw two young queens meet on the flight-board of a hive while a second swarm was issuing from it. They ran and embraced each other in furious combat; but, as we wished to obtain the second swarm, we tore the combatants asunder, and threw them up in the air. Both went with the swarm. Next morning one was found dead in front of the hive into which the swarm was put.

CHAPTER VII.

FERTILE WORKERS.

About these we can say nothing. Many respectable bee-keepers believe that fertile workers occasionally exist. Those that write about them admit that their existence in hives is very rare indeed. If Mr Woodbury is correct in his opinion, they never leave home. Though we have never seen one, and once offered £10 for one, or a dozen of her eggs, we are not now disposed to question the evidence of those who say they have seen them. Huber's opinion as to the cause of the fertility of a working bee is very lucidly stated in his book—a book which has less weight and authority amongst advanced and intelligent bee-keepers now than it had when first published. He says, "Fertile workers are reared by the sides of royalty. When the bees are feeding young queens in their cells, a little of the royal jelly or food goes by mistake or accident into common cells, and there does the work of fertilising common workers." We are utterly ignorant about fertile working bees.

CHAPTER VIII.

HONEY.

This substance or sweet juice is found in the flowers of certain plants in almost every country. Doubtless it is odoriferous, and hence bees, whose scent or smelling powers are wonderfully keen, can easily find it. They are furnished with proboscises of some length, wherewith they can reach most of the nectaries of flowers in which honey is found. It has been said that at the point of each proboscis there is a little brush of exquisite softness, which is used for collecting the honey, and thus enabling the bee to fill its own bag. But we cannot speak of this brush, or of the manner of collecting honey, without getting into cloudland and difficulties. These subjects are left for those who have studied the anatomy of the honey-bee.

The honey as it is collected in the flower and carried to the hive is not honey proper. It is a thin sweet juice, deposited in the first open cells found in the hive by the bees. During the day they carry as much home as possible, and during the night they re-swallow it, when it undergoes a thickening process, and thus becomes honey proper. Before it is swallowed a second time, it readily runs out of the cells whenever the hive is turned up or a little to on side. But after having been put twice through *the stills* of bees it is not easily disturbed. Be-

sides, the taste is considerably improved. Doubtless there has been much water eliminated during the process.

The honey of one plant, it is believed, is different in some small degree from the honey of other plants—different in substance, colour, and taste. For instance, the honey collected from the flowers of gooseberry and sycamore trees is of a sea-green colour, the flavour of which cannot be surpassed for excellence. The honey collected from the flowers of Dutch or white clover is clearer—more like spring-water—than any honey gathered from other flowers known in England. It pleases the eye better than honey of a higher colour. The flavour of clover-honey is good and pungent, but not so rich and pleasing to the palate as that of sycamore and gooseberry.

Honey gathered from heather-blossoms is considerably darker in colour than any other pure honey gathered in Great Britain and Ireland. It has a much stronger flavour too—peculiarly *grouse-land*. We have tasted honey from Australia very much like our heather-honey. This heather-honey, though to appearance of greater substance and consistence, is considerably lighter in weight, taking bulk for bulk. The clear sort goes to the bottom of the jar, and the heather is on the top. In England the clear honey is greatly preferred. It was the same in Scotland thirty years ago.

In the mind of the thoughtful reader the question will arise, whether bees do or do not impoverish our fields by sucking the sweets out of their flowers. Twenty acres of white clover will yield to bees 100 lb. of honey every day favourable for gathering honey. If the bees get 100 lb. per day, will the cows suffer at all? Will their milk and butter be equal in quantity and quality to those whose pastures are never much visited by bees? I remember mentioning the case of a parsimonious old farmer

whose fields were much visited by bees. So convinced was this old farmer that the bees *robbed* his fields, that he trod to death all he could put his feet upon, and even threatened to drag the horse-roller over them. The late Dr Lindley said, "this old farmer was a great blockhead." Honey in the flower may be said to be a volatile oil, which is constantly passing into the atmosphere by evaporation. Ungathered by bees, this substance "wastes its sweetness on the desert air." Hundreds of thousands of tons of honey are thus wasted in England every year, for want of bees to collect it. If bees collect the contents of a flower in the morning, a second visit in the afternoon will find it as full as ever. A land flowing with milk is, in one sense, a land flowing with honey. Honey-flowers, like cows, will bear milking twice and thrice a-day, and be none the worse for it. The farmer will not find that the five or six pounds of honey per acre extracted from the flowers of white clover affect the produce of his dairy in the smallest degree.

CHAPTER IX.

HONEY-DEW.

This material is found on the upper surface of the leaves of trees, has a shining appearance, and is sticky to the touch. Many ignorant people in the country think it falls from the skies during the night. It is simply the product of an insect (aphis) found frequently on the under sides of the leaves of certain trees. This kind of insect is most plentiful in times of prevalent east winds, and it is well known that flowers yield very little honey indeed when the wind comes from either east or north. In these times of scarcity the bees work on these shining leaves, and thus collect honey-dew. Two years ago—both in England and Scotland—considerable quantities of it were gathered and stored in the hives. It is dark in colour—disagreeable both to the eye and the palate. Last year our bees collected so much of it that much of our honey was unsaleable. It was our good luck never to become acquainted with it till 1867; and last year, 1869, we became familiar with it. Some of it is in all our hives, numbering above forty stocks.

Will it injure the health of the bees? This is a question we are unable to answer at present. If the mortality of our bees is great this winter, the dark honey will be blamed for it. Fortunately there is not much of it, compared to the good and pure honey, in the hives—perhaps

about one-twelfth part only. But, unfortunately, it does not candy or crystallise like good honey. If the bees eat the liquid black stuff at this dull season of the year, and leave the beautiful crystallised honey untouched, it is to be feared that their ranks will be much thinned during the winter months; for we know that the mortality of bees fed on the best of heather-honey is greater than that of those fed on the honey of fruit-trees and white clover.

Honey-dew is a great nuisance to bee-keepers whose aim is profit. It is a great pity that bees touch it at all.

CHAPTER X.

WAX.

Wax is not gathered like honey, or pollen, or propolis. If bees could gather it, it would cost them less than it does. They have to *manufacture* it at very great expense—great expense to themselves and their owners. As milk is manufactured in the body of the cow, so wax is manufactured in the bodies of bees. It is both a secretion and excretion of bees. In collecting honey, bees carry it in their bladders or bags, and when they *wish* to make wax and build combs, the honey goes into their intestinal canals, passes into the juices of their bodies, and scales of wax ooze from, or are excreted on the under sides of, their bellies. Wax, then, is a "home-spun" article, wholly made or manufactured by the bees themselves. Dr Liebig, in his appendix to his great work on 'Animal Chemistry,' says that "bees have to consume 20 lb. of honey to make 1 lb. of wax, and that 1 oz. of comb holds 1 lb. of honey." We do not vouch for the accuracy of Liebig's calculations or experiments, but they are stated merely to show that wax costs the bee-keeper a great deal more than he gets for it in the market. But we are not quite sure that 20 lb. of honey are consumed in the manufacture of 16 oz. of wax. A swarm was put into an empty hive. This swarm and hive and board would weigh about 17 lb. In seven

days after—or seven and a half, for the afternoon of the day of swarming was not included—this hive weighed 45 lb., and was filled with combs. These combs, pure and simple, would weigh 2 lb. If 40 lb. of honey were consumed in the production of the 2 lb. of wax, the gathering of this swarm was enormous. Who can believe that this swarm consumed 40 lb. and stored up about 20 lb. of honey in seven days? Liebig's experiments were honestly made, and the results honestly recorded, but no close observer of comb-building in bee-hives will admit that they are, or ever can be, representative in their character. Why? The experiments were made with about 10 oz. of bees—a mere handful. Both the weather and the warmth of a hive have a great influence in comb-building.

Dr Liebig says that it takes thirty-eight hours to convert honey into wax; that is to say, that the laminæ or thin plates of wax do not appear on the bellies of the bees till thirty-eight hours after it has been taken into their intestines. This surely is not correct, for bees that are driven into a hive at six o'clock of a summer evening, often commence to build combs before six o'clock next morning. And if no combs be formed or visible then, there will invariably be seen laminæ or flakes of wax lying on the board inside beneath the swarm. The making or secreting of wax is voluntary on the part of bees; and this is one of the secrets of bee-history that can never be fathomed. Bees do not secrete wax when their hives are filled with combs; but remove the bees from a large full hive into an empty one, and in less than twelve hours they make two or three pieces of comb.

Wax is made from syrup or treacle as well as from honey, and neither pollen nor water is necessary in its production. If a swarm were put into an empty hive,

and carried to the bottom of a coal-pit, and there fed, combs beautifully white would be the product. But combs made from syrup are more brittle than those made from honey; and combs made from the honey of one kind of plant differ in colour from those made from another kind.

In the covers or lids of brood-cells there will be noticed this fact, that they are always like the cells they cover. If the combs are ten years old, and as dark as an Ethiopian's skin, the lids are of the same colour; and if the combs are white the lids are white. Doubtless part of the old combs in the dark hives is used in the manufacture of lids; but why it is so used, or why bees will have lids and combs of the same colour, has ever appeared a very remarkable thing.

In Professor Liebig's remarks on wax, there is another statement which is not absolutely correct. He says combs are never built in a hive unless the bees have the presence or prospect of a queen. Now we have seen a second swarm that lost its queen a day or two after being hived, half fill its hive with combs, chiefly of the drone kind.

These quotations from Liebig's invaluable book are made, not with a view to combat them, but to let the reader know that the question of wax-making and comb-building is a very important and interesting one in the history of a bee-hive. In comb-building the bees are wonderfully frugal in the use of wax. We guess that not more than 2 lb. of it is used in the construction of 80,000 cells. It is a very inflammable substance, containing more than 80 per cent of carbon.

CHAPTER XI.

BEE-BREAD.

This is the pollen or farina of flowers. Bees can with great ease gather it, and carry it home in pellets sticking to their hind legs. Some writers say that every bee is furnished with two baskets in which this pollen is carried home. Of course the colour is different in different kinds of flowers. Bees do not change its colour. Anciently it was considered crude wax, and even now many think it is made into wax. It is not capable of being made into wax. It is used principally for feeding maggots in their cells, and hence it is termed bee-bread.

If it were required for the building of combs, swarms put into empty hives would gather much of it; but we find that all such swarms do not gather any pollen for some days, or till combs are built to contain it. After some combs are built, the bees are seen returning with pellets on their legs. In most hives it is stored in their centres where the young are hatched, and too often there is stored up more than is required. If cells are filled, or half or quarter filled, with farina, they are useless for the time being for breeding purposes. Some seasons are remarkable for the abundance of it stored up, and some hives have more than others. It is never a scarce article, and the hive that has fewest cells filled or half

filled with it, is generally the most prosperous,—all other things being equal.

Three years ago we had a hive which we considered second to none. In the autumn previous it received a large swarm, and therefore was very populous. It was a large hive, and weighed about 50 lb. It was deemed the best hive in our possession. It lost but few bees during the winter. We expected an early swarm from it, but somehow it loitered behind the rest. It gathered three, four, and five pounds of honey a-day off the fruit-tree blossoms. Still it did not come up to the swarming point. At last we swarmed it before it was ready; and three weeks later we drove all the bees out of it into an empty hive. We then found the cause of its sluggish movements: four-fifths of the breeding combs were filled with farina or bee-bread. Pollen is mixed with honey and water when used in the feeding of young bees. And occasionally it may be mixed with wax in the manufacture of lids of cells. Bees do not eat it. They die of starvation with a superabundance of it in their hives.

CHAPTER XII.

PROPOLIS

Is a kind of cement used in hives to fill up all holes and cracks, and prevent unnecessary ventilation. It is a substance not absolutely necessary to the wellbeing of a hive, but doubtless the bees derive benefit from using it, otherwise they would not collect it. It is a sort of resin or gum. A few ounces' weight, at most, is all that is found in the largest hive. It is generally considered that the bee-glue or propolis is collected from the buds of poplar and other trees, and also from the resin of old pine-wood exposed to the rays of the sun. Doubtless, trees wounded may yield some. It is a very much harder substance than either wax or bee-bread.

CHAPTER XIII.

WATER.

A VERY great deal of water is carried into a hive in the height of the breeding season. It is used with bee-bread in feeding young bees. It is collected in dewy mornings, and after showers, from the blades of grass and the leaves of plants. In the absence of showers and dew, bees resort to brooks, rivers, and water-tubs for it. In dry seasons we have often seen them suck it out of the soil that has been artificially watered. It has been a marvel to us how speedily they scented the water falling from the water-can into the soil. Bees do not store it up; they seem to act on the conviction that "sufficient for the day is the supply of water." The sight of bees seeking and sipping water, is a proof that breeding is going on in their hives. During inclement weather, when not a particle of honey can be obtained, bees often venture out for water.

Mr Quinby thinks that much water is necessary in comb-building. Bees placed in a dark cellar, he says, have been known to raise brood without water. This may be true; but probably the bees used the moisture condensed on the insides of their hives, Mr Quinby's hives being made of wood. If Mr Quinby were to try the experiment, he would find that bees can build combs in great quantity without water, in a dark cellar, more readily than they hatch brood there. In spring months water is extensively used in hives, and long before comb-building commences.

PART SECOND

PRACTICAL MANAGEMENT

PART SECOND.

We now come to the practical part of our work; and our aim shall be to make the reader understand everything necessary to the successful and profitable management of bees. This book is not written for the benefit of the advanced students of bee-history; and if they chance to look into its pages they will find some things twice repeated, and evidence enough of an *extra* effort made to instruct the most ignorant to manage his bees intelligently and well. It is Cobbett who says that all books should be written for the benefit of those who are entirely ignorant of the subjects of which they treat. If this is necessary on most subjects, it is absolutely necessary when the subject of the bee-hive is considered, because the bees in that hive have stings, which tend to prevent investigations being made by new beginners.

The reader is requested to remember, that our stating certain facts and opinions will not make him, or anybody else, an intelligent bee-manager, unless his mind be fully convinced and held captive by the reasonableness of such statement. All is to be weighed in the balance of his own reason, and whatsoever is found light and wanting he will cast aside. If a thing must be done, please to let us have the *why* and the *wherefore;* and then tell us *how* to do it.

CHAPTER XIV.

THE APIARY OR BEE-GARDEN.

It is not which garden, but which place in the garden, shall the bees occupy? Every bee-keeper consults his own convenience in the choice of a spot on which to place his bee-hives. Near the door, or in front of a window, from which the swarms can be seen, is generally preferred by cottagers, for they have not much time to lose in watching for the swarms leaving their hives. So far as honey-gathering goes, one corner of the garden will answer as well as another. And it does not matter much, if anything at all, whether the hives look east or west, north or south. Hives placed in the centre of a wood or small forest, where the rays of the sun never reach them, thrive about as well as those placed outside to bask in his smiles all day long.

A sheltered corner, with an open space in front, and at some distance from ponds or sheets of water, is perhaps the best possible in any neighbourhood for bees. If hives are placed in an exposed and bleak situation, or near sheets of water, high winds do a little harm to them. Bees with heavy loads are fatigued when they return to their hives, and therefore it is desirable to let them enter them as safely and speedily as possible. If driven to the ground by the violence of the wind, they sustain a rueful

shock, and have to rest a considerable time, and perhaps be driven down a second time.

In the winter time a sunny spot is of greater advantage to bees than it is in the summer; for when bees come out for a dance and airing during the dark days of winter, the rays of the sun prevent many that sit down to rest from being chilled to death. Still, practically and experimentally considered, the advantages of such sheltered places are of small importance. If the pasture of the neighbourhood be good, bees will do well wheresoever placed. On the housetop and on the bleak hillside, underneath the hedgerow and in the open field, we have found them to thrive exceedingly. We have seen them placed amid lofty houses, where they were compelled to rise to their tops in short spiral turns, and drop down about as perpendicularly as a bucket in a well, and yet, in this position, collect from 4 lb. to 6 lb. per day, per hive, in fine weather. An unfavourable position for an apiary will not, we hope, prevent any of our readers from keeping bees, for they have wits and ingenuity enough to make the best of every position. A warm sheltered place is, however, recommended for the home of bees.

How far should hives be off the ground, and how far asunder?

We think 8 inches above the ground is quite enough, and most of our hives in summer are not more than 4 inches above the level of the ground. But why keep them so near the ground? Is the health of the bees not affected when placed near the earth? Bees are as healthy when placed 2 inches above the ground as when placed 20. If hives are raised 2 and 3 feet above the ground, the bees, when heavily burdened, often miss the flight-board on their return from the fields, and thus come un-

expectedly to the ground; and, by reason of the sudden and severe shake, they do not rise for some time, and many are chilled to death ere they gain nerve and resolution enough to make another attempt.

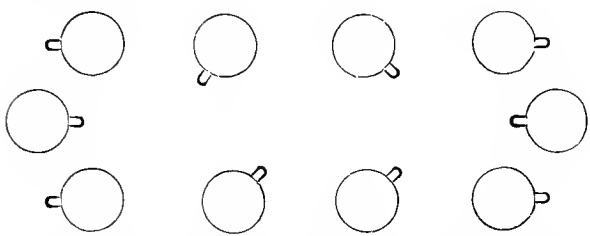
If an elevated position has any advantages at all, we have hitherto failed to learn what they are.

Three posts, about 15 inches long, driven half their length into the ground, answer well for a stand for one hive. These posts are driven into the ground about 15 inches apart, and the front one a little lower than the two behind, so as to make the rain run off the flight-board, and not into the hive. Three round stones or river bullets, half buried in the soil, will answer as well as the posts. In fact, anything that is well grounded and secure, and rising a few inches above the ground, is *quite as good* as *something better* for stands for bee-hives. Some bee-keepers are of opinion that bee-hives are like corn-stacks, if not placed high above the ground vermin will go in and eat their treasures. A very little schooling will teach these men how to keep mice out of their hives, without hoisting them aloft on ugly single posts.

How far should hives be placed asunder? As far as convenience will permit. When we come to the chapter on artificial swarming, it will be pretty evident to the reader that 6 feet distance between stock hives is near enough. Many reasons could be given in favour of some distance being left between hive and hive. When apart 5 or 6 feet, young bees and young queens do not mistake their own hives; but if hives are near each other, mistakes may and do happen, and ruinous consequences follow.

But where many hives are kept, would you have them spread all over the garden? No, if economy of space and

compactness of appearance are objects aimed at. Besides, it is possible to place a great many hives within small compass, and be free from all danger of receiving mistaken visits. Many of our hives are removed, in spring, to cottage and market gardens in the country. We pay rent for a small space, and make it answer well. The following representation will show the reader how ten hives can be safely placed on a spot not much larger than a dining-room table.



Every hive is separate from the rest, and so placed that there could be no mistakes made by the bees as to their own hives; but there is not room enough between them to hold a swarm from each hive without risk.

As there is a peculiar smell in each hive, which appears to be the bond of union in the community of it—bees knowing each other by smell—the intelligent bee-master will keep his hives as far asunder as he can conveniently, or sufficiently far to prevent the peculiarity from being lost. Close proximity may destroy it.

CHAPTER XV.

BEE-HOUSES.

It appears a work of supererogation to say a word about bee-houses in a work on the profitable management of bees. Such houses are very expensive and inconvenient. All bee-keepers of experience consider them a hindrance to good management, and objectionable in many senses. We have nothing to say in their favour, save this, that they help to protect hives from the severity of winter storms. Of course there are people who will have bee-houses, and have them to please the eye of the most fastidious, real models of beauty and architecture. One gentleman in this neighbourhood built one, some four years ago, at a cost of £20. He placed some hives of bees in it; but every year something went wrong with them. We called this season to see them, about swarming time. We found three hives on one bench, containing bees of the most social and neighbourly characters and dispositions we had ever seen; for they marched in and out of each other's hives in the most *friendly* manner, apparently without let or hindrance. This gentleman met the writer about a month ago, when he said—"I have lost all my bees; I can't manage them." No wonder his bees did not prosper. In bee-keeping there is no profitable return for foolish and unnecessary expenses. If this gentleman's bees had been kept apart, on separate stands, he would have had success instead of loss and disappointment.

CHAPTER XVI.

THE PASTURAGE OF BEES.

What a mint of money, what a mine of wealth, rise up before the mind of a thinking man as he approaches the consideration of this subject! Bee-pasture? A mint of money? A mine of wealth? Why, sir, you once said that, "At the rate of £2 profit per hive, it took fifty bees a whole season to earn one farthing's worth of honey and keep themselves." Why, then, talk about a mint of money in connection with this subject? Stop a little, and think a bit! How many hives will find ample pasture in a parish four miles square, containing 10,000 acres of land? How many parishes, some larger, and some less, in every county? If a twenty-acre field of grass, well sprinkled with the flowers of white clover, yield to the suck of bees 100 lb. at least per day, value £5, and strongly scent the air as well—and twenty acres of good heather yield probably 200 lb. of honey per day, value £20,—who will venture to calculate, and give the sum total of honey-value of all the counties of Great Britain and Ireland? We remember being startled at the statement of a citizen of Manchester, in a paper which he read before the British Association for the Advancement of Science, while that Association met, two or three years ago, in this city. I forget the title of the paper, but the subject was the poisonous exhalations of the city. The

number of tons of carbonic acid gas constantly passing off into the atmosphere was named, a number great enough to quicken the attention of all sanatory reformers, and the movements of the Corporation of Manchester. But who can accurately weigh or number the millions upon millions of pounds of honey that pass away (ungathered by bees) into the atmosphere? Who can estimate the millions of pounds worth of honey thus wasted on the "desert air"?

Suppose a mild form of *mania* were to seize the railway porters of the wayside stations of the various railway companies of this country; and suppose it were to run in the direction of bee-hives. Well, what then? There can be no better position for bees than the banks of our railways. If fifteen hives were placed on an average per mile, how much income would be derived? At the rate of only one pound per hive annually (about one-half the usual rate), 500 miles would return £7500 yearly. If our worthy porters were to receive Christmas presents to the tune of £15 per mile of line, they would doubtless be pleased and full of gratitude; but if the money were to come from bees, and a little attention given to them, they would be equally enriched in purse, and probably much more so in mind, by their uplifting acquaintance with the industry and economy of honey-bees. "A land flowing with milk and honey" is this England of ours. Cows we keep to yield the milk: bees are either not kept or greatly mismanaged; hence the honey is not gathered.

But is it not possible to overstock a given locality or parish with bees? Yes; though we have never known one overstocked. We have known from fifty to one hundred hives standing in one garden, the stronger of which gained from 2 lb. to 5 lb. per day in fine weather. If

the number had been twice as large, the probability is great that the gains or accumulation of honey would not have been perceptibly less in any of the hives. If there be food enough in a grass field for thirty head of cattle, it does not matter much to the cattle whether ten or twenty be kept in it: there will remain grass uneaten. So with bees there is in almost every place far more food for them than they can gather.

But are all localities equally good for bees? No; there is a great difference. Some are very much more honeyed than others; and some are rich at one period of the season and poor at another. In my own garden, on the immediate south of the black city of Manchester, bees do very well in spring—till the apple-tree blossoms fail; afterwards it is a poor, poor neighbourhood for bees. They can barely keep themselves in ordinary seasons—in extra fine seasons they gather small stores of honey. We find it desirable to remove them farther into the country, where they can find better pasture. We have alluded to this elsewhere, and may allude to it again.

It is perhaps beyond the powers of the most observant and best-informed mind in the realm to name every plant in this country that yields honey, or from which honey may be gathered. Their number is great. But as there are some of greater value to bees than others, we will now mention those which we consider the best for yielding honey. In one small work on bees in my library there are upwards of seventy bee-flowers enumerated, and put in classes for spring, summer, and autumn.

Crocuses in early spring receive great attention from bees. Much pollen and some honey are collected from their flowers.

In some places there are two kinds of *willow* (*salix*)

which bear yellow flowers, beautifully conspicuous, in early spring, which are much visited by bees.

The border *hyacinths* of our gardens—the same sort as are forced to decorate and scent our conservatories—furnish bees with many a sweet mouthful.

Single wallflowers—grown largely in some localities for cut flowers and seed—are excellent for bees.

The flowers of *gooseberry* and *plum* trees are superexcellent, yielding honey of the finest quality in great abundance.

Apple, *pear*, and *currant* trees are also of great value to bees, furnishing the bees with rich and large stores of honey. *Cherry*, *peach*, and *apricot* are also honey-yielding plants.

Field-mustard (*sinapis arvensis*), which is a weed, superabounding in some districts, frequently covering our cornfields with its yellow flowers, is an invaluable thing for bees. In Derbyshire this plant is called *ketlock*, in Lanarkshire it is called *skelloch*, and in Wigtownshire it is termed *ranches*. Here, in Lancashire and Cheshire, it is called *the yellow flower*. It continues a long time in flower, and the honey gathered from it is very clear and excellent. The flowers of *turnip*, *cabbage*, and all the *brassica* tribe, are exceedingly tempting to bees, and yield them large supplies.

Field-beans are about as rich in honey as they can be —rich in quantity and rich in quality. There is some mystery as to the means employed to extract it from the flowers of beans, which are tubular in shape, and of considerable thickness. The honey, of course, lies at the bottom of these flowers—deeper than the length of a bee's proboscis. The tubes are pierced or tapped near their bottoms, and through the holes thus made the bees extract much rich treasure. It has been said that bees are unable to pierce the tubes of the flowers, and that the

holes are made by humble-bees, which have greater powers. No one can watch humble or earth bees at work in a field of beans, and remain in doubt that they do some work in this way. They do push their trunks through the petals of the flowers with a view to reach the honey; but the question is, Can bees make holes for themselves, or do they merely make use of the holes made by humble-bees? We have never seen a honey-bee make a hole through the petal of a bean-flower; but, from the scarcity of humble-bees in some neighbourhoods where bean-flowers are found well pierced, we are ready to believe that the "jemmies" of our own friends are used for breaking through the thick walls of bean-flowers.

Maple, *sycamore* (or *plane*), and *lime* trees are of great value to the bee-farmer. Maples are not so abundant in this country as sycamores and limes. Honey is not distilled from the flowers of the sycamore, but it literally lies on them, and is clammy and sticky to the touch of human hands. Elsewhere we have said that the honey gathered from the flowers of sycamore and gooseberry trees is of a sea-green colour, rich and highly flavoured.

The strong and rather pleasant scent of lime-trees in flower, and the music of bees busy at work on them, indicate that honey in abundance is collected from them in the month of July.

Wimberry, *raspberry*, and *brambleberry* deserve honourable mention as honey-producing plants. Wimberry-bushes—acres, and scores of acres of them—abound in moorland districts. They flower early, and are rich in honey; but as few bees are permanently kept in such neighbourhoods, the honey produced by them is lost.

Borage, *mignonette*, *heliotrope*, *buckwheat*, and *birds'-foot trefoil* (*lotus corniculatus*), *gorse*, and *broom*, are useful in their day.

White or Dutch clover is *the queen* of honey-plants. It is widely cultivated in this country, and continues to flower a long time. In Scotland the farmers use more white clover seed in laying down the land in grass than the farmers of England; hence the clover-fields are better there than here. And the use of lime and bone-dust as manures has a great influence in the production of clover. In travelling to Edinburgh some years ago by the Caledonian line, whole fields white with clover-flowers caught my eye, and made me take a second look to see if the whiteness came from daisy-flowers. Whole districts, unsurpassed for excellence, met my eye during a visit to my native land, many of which hardly ever received a complimentary visit from bees, and for this reason, that there were no bee-keepers in these districts.

I verily believe there is more wealth (in honey) in the clover and heather fields of Scotland than there is in the gold-fields of Sutherland—if not of California; but few people know it, otherwise bees would be kept to collect it.

Pastures eaten bare by cattle are, of course, not so good for honey as those less severely eaten. And apart altogether from the bee-keeper's view of the matter, the wisdom of the farmer in putting too many cattle into his fields is not very evident. Bare pastures keep cattle constantly on the trudge, wasting their substance in seeking food which, when easily obtained where grass is abundant, goes to form either milk or flesh.

Sheep are fonder of clover than cattle, and more able to nibble off its young heads; hence sheep-pasture is inferior in a honey point of view to cow-pasture. "A land of milk and honey," is a more congruous term than one of "mutton and honey."

Clover is more uncertain in its yield of honey than most other plants, inasmuch as it is more easily affected

by cold nights than they. Three years ago, a stock-hive from which one swarm only was obtained was weighed every morning during the hot weather of July. On the 17th and 18th it gained 12 lb. in weight, next two days only 4 lb., and on the following day it gained 4 lb. The differences of honey gathered was attributed to the variation of night temperature, for the one day was as hot as the other.

Heather-blossoms, during the months of August and September, yield a harvest of honey prodigiously and marvellously large. This is so well known, that in Scotland, and some parts of the Continent, there may be seen cart-loads of bee-hives going to grouse-land. Bee-keepers find that there is an ample return for the trouble and expense of taking bees to the moors, even though the distance be thirty or forty miles. On no spot of Scotland can it be said that heather is not within easy distance of it, so that all Scottish bee-keepers can avail themselves of the honey that is so abundantly produced by its pinky-purplish blooms. To me it appears wonderful that we have in England heather enough for all the bees in the world. In Yorkshire there are magnificent seas of it. On the hills of Derbyshire, within twenty miles of Manchester, we find miles of heather that cannot well be surpassed for excellence. In the south, we find heather in Devon, Sussex, and Hampshire. I have seen it, too, in Warwick-shire; but of the quantity I cannot speak from personal knowledge. In Ireland, Wales, and the most northern counties of England, it is as abounding and "comeatable" as it is in Scotland. Heather-honey is so different in taste and appearance from other honey, that it is called in Scotland "heather-honey," all the rest being termed "flower-honey."

It need not be said that plants grown on warm well-

drained lands yield more honey than those grown on cold heavy soils. Even in the case of heather this is true. In ordinary seasons heathery hills yield more honey than heathery swamps. And the good sense of every bee-keeper will tell him that hilly exposed pastures and districts are, in showery seasons, much better for honey than flat and sheltered ones. We have known hives placed in hilly districts increase greatly in weight in such seasons; whereas those standing in low sheltered places could scarcely keep themselves, the flowers being hardly ever dry. In very droughty seasons the low sheltered parts may be the better of the two for honey-gathering.

HOW FAR WILL BEES GO FOR HONEY?

This question we cannot answer. Our experience in this matter goes dead against the wonderful stories that are told in some books. We read of bees flying four, seven, and twelve miles for food! Our bees will droop and die within four miles of rich pasture. In the finest of weather they fail to smell or taste it. In fine sunshiny weather bees go farther from home for food than they do in dark cloudy weather. We find this out by removing hives to a distance of two or three miles at such times. In cloudy weather very few bees will return two miles to their old stand. Considerably more return when removed in bright weather. But even in the best and brightest of weather in June and July, very few, if any, find their way home to their old stand if removed three miles. But even the return of some bees does not prove that they travel three miles in search of food. It proves that some of the bees travel a little more than one mile and a half from home, and finding themselves on known

pastures within one mile and a half of the old place, they return thither, forgetting, as it were, where they came from *last*. I am therefore of opinion that few bees go from home more than two miles in search of food.

How desirable, then, to have bees as near as possible to the pastures on which they work! Short journeys are not only a saving of labour to bees, but also a protection of their lives. When compelled to fly far for honey they are often caught by showers and destroyed. In warm genial weather, with a superabundance of honey in the flowers, bees *will* have it. They will even go beyond the bounds of safety for it. Gentle showers do not stop out-door labours. Black clouds often send them home with all speed. But they are frequently caught, and die on the altar of their industry. Hives containing 8 lb. and 10 lb. of bees have lost two-thirds of their ranks by sudden showers in warm honey weather. Bees driven to the earth by showers do not die at once. If the following day be warm and fair, the rays of the sun sometimes reanimates these storm-beaten creatures, enabling them to return to their hives with joy and gladness.

CHAPTER XVII.

HIVES.

As we have now come to the most important chapter of the book, it is hoped that all readers seeking profit from bee-keeping will try to go through it in the light of common-sense. Bees ever have been, and ever will be, profitable to their owners, *when well managed.* Most bee-keepers in England are apparently fifty years behind the day; they have yet to learn the A B C of profitable management. Agriculture has made great advancement during the last half-century, so has horticulture, and they are not going to stand still now. But apiculture, alas! makes but poor progress, if it moves at all. What hinders it? We repeat and emphasise this question, *What hinders it?* When the astronomer discovered and reported the fact that the planet Uranus loitered in one part of his orbit, it was an act of common-sense on the part of another man to push his telescope towards that part in order to find out the hindering cause. He was thus successful in discovering another immense planet (Neptune) lying far behind, the attractive influence of which is so great as to impede and hinder Uranus in his race or course round the sun. Now there is something which hinders the bee-keepers of England from making as much money of their bees as they ought. Twenty-five years ago we told them that all the books that were ever

published, and all that we could possibly say, would never put them on the highroad to the successful and profitable management of bees unless they kept *large hives.*

Bonaparte, the great general, soon found that good luck attended those who had most cannon; and he said, "God was always on their side." So in bee-keeping, good luck attends those who use hives large enough to hold many bees. The secret of profit is here. It is rather puzzling to do sums in practice before the multiplication table has been mastered: it is equally puzzling to get large profits from small hives, so generally used in England. We are well aware that it is a difficult matter to remove prejudices of long standing. When water cuts its own channel it runs along it, year after year. To a large extent bee-keeping has done the same. We are glad to see some signs of an alteration taking place. The adoption of large hives by one or two bee-keepers of intelligence and ability in every county would, in process of time, revolutionise bee-keeping throughout the country.

Having far more confidence in the power of facts and figures than in that of logic and argumentation for convincing men not remarkable for activity of brain, that large hives, well managed, are incomparably better than small ones, we have of late recorded the results of bee-keeping in our native village, where hives are of considerable dimensions. These records have already stimulated the attention of many bee-keepers throughout the country, and in several parishes adjoining or lying near Carluke, the pluck and energy of many bee-masters are in full play. If the weight of Carluke swarms rise up to 100 lb., 130 lb., and 160 lb. each, according to the season, why not elsewhere? In 1864, the weights of an old hive and its two swarms, belonging to Mr Robert

Reid, Carluke, were published in the 'Hamilton Advertiser' of that year:—

"Old stock, or mother, was	92 lb.	weight.
First swarm from it,	160 „	„
Second swarm „	76 „	„
Altogether,	328 lb.	weight."

In the year 1865, the first swarms at Carluke weighed about 90 lb. while on the clover; but when taken to the moors many had lost weight, owing to the weather being unfavourable for gathering honey.

The heaviest swarm of 1866 at Carluke was 148 lb.

The account of the success of bee-keeping in 1868 came to me in a letter from my friend Mr Reid, part of which I will now quote:—

"Carluke, 25*th Sept.* 1868.

"My dear Friend,—We brought our bees home from the moors the week before last; the weather being fine, we thought they would be gaining weight, but were wrong. Henshilwood got his home about ten days before us. During that time ours lost 8 lb. and 10 lb. each in weight. Our heaviest first swarm was 112 lb. —another about 6 lb. lighter. Our best second swarm weighed 75 lb.

"Robt. Scouler had three first swarms, which were about 120 lb. each; and his best was 130 lb. John Jack had two stocks in spring, which did better than most. One first swarm weighed 161 lb., another 104 lb.; and a second swarm was 68 lb. I have not heard of the weights of the old ones, but he took 230 lb. of honey from the produce of his two stocks.

"Samuel Dempster had two also in spring. His two first swarms weighed respectively 110 lb. and 148 lb. Henshilwood had one 168 lb., and my brother had one 130 lb.

"*P.S.*—Scouler had two seconds, one of which weighed 80 lb., the other 90 lb.—Yours truly,

"ROBERT REID."

Mr Reid's letter containing the results, or some of them, at Carluke for 1869, has already appeared in print, in connection with our own balance-sheet, which appears annually:—

"CARLUKE, *5th October* 1869.

"MY DEAR OLD FRIEND,—I beg to be excused for not replying to your note sooner, but I waited till I got my bees home from the moors and the honey taken from them. I jarred it all up yesterday, and find that out of the 10 hives we have taken upwards of 400 lb. of honey. The heaviest hive was 120½ lb., two or three of them about 90 lb., the rest from 60 lb. to 70 lb. each. We had three boxes of honeycomb, which realised 27s. And one second swarm, 80 lb. weight, was sold for £2, 2s. The above is the produce of six stock-hives, so you see the bees have done well with us this season.—Yours truly,

"R. R."

The heaviest hive in the parish for 1869 was 128 lb. And an old widowed aunt of the author's got 250 lb. of honey from four stocks.

These facts and figures are quoted with the view of stimulating the attention of bee-keepers generally. We are of opinion that agricultural and horticultural exhibitions do more to advance the sciences of farming and gardening

than the teaching of books and periodicals; and we fancy that example, even in bee-keeping, is better than precept. When we resolved to write a book on bees for publication, we sent the following three questions to bee-keepers in many counties:—

I. What is the general size of hives used in your county? II. What time does swarming commence? III. In good seasons what weight are the first swarms at harvest-time?

Our correspondent near Norwich, in Norfolk, says: "The hives used here are rather smaller than usual; the middle of May is a good time for early swarms; and at the end of the season a good stock may weigh only one stone. This may surprise you, but some are not half that weight."

From Yorkshire, a gentleman at Hull answered the questions as follows: "The size of the hives used hereabouts contain about 1300 cubic inches, and swarm about the first week in June. As to the general weight, that depends on the management of them. The most I have ever taken from a swarm was 32 lb."

From Wycombe, in Buckinghamshire, we learn that "the first week in June is the time of general swarming; the size of the hives about 12 inches deep and 12 inches wide; and the weight of swarms at the end of the season depends on the summer. If not much rain to stop their work, a good swarm *ought* to weigh 30 lb."

Our informant in Cornwall (Lewanwick) says: "In favourable and pleasant spots, bees begin to rise from the 16th to the 20th of May; but the time of general swarming is the first and second week of June. The size of the hives in use is, I think, about 14 inches diameter and 11 inches deep. The average weight in good seasons is about 28 lb., hive and combs together; the heaviest I have ever

known was 35 lb. Taking one year with another, the average produce of a hive is about one gallon of honey. In the parts of Devonshire which I have visited, bees appeared to be treated much as we treat ours, the hives being a little less, if anything."

In Lincolnshire, "Swarming generally takes place from the 10th to the 20th of June; hives 12 inches diameter and 8 or 9 inches deep; and the weights of good swarms range from 30 lb. to 45 lb."

"We think," says our Devonshire correspondent, "25 lb. to 30 lb. a good weight for swarms in common hives; I have known some 50 lb., but this is rare. I do not think your figures could be approached in this county with hives of any size."

We happen to think differently of Devonshire, and believe that if large hives were introduced and properly managed in that splendid county, the honey-harvests would be enormous. Instead of swarms being rarely 50 lb. each, they would often be 100 lb., and sometimes 150 lb. each.

Having lived eight years in the neighbourhood of London, we may be allowed to state that bee-keeping there, and in Hertfordshire, has not improved one iota since the days of Shem, Ham, and Japheth. So in Oxfordshire and other parts of England.

Let us now go to Northumberland, where we are told "that the time of general swarming is the month of June, but some early swarms are obtained about the 18th of May. The general size of the hive here is 15 inches in diameter and 12 inches deep; and the best hives at the end of an average season contain from 25 lb. to 35 lb. of honey." Northumberland is a long way in advance of any other county south of the Tweed that has responded to our questions.

Ayrshire and Perthshire, according to the figures we have received, are about on a par with Northumberland, Wigtownshire, and Mid-Lothian; but other parts of Scotland are represented by figures indicating their honey-harvests as being rather less than that of Northumberland.

Now, come back to the parish of Carluke, and tell us if you think that the great success of the bee-keepers there is owing altogether to the use of large hives. No, not altogether. A great measure of their success comes from good management. But good management, without large hives, will not end in great results, large hives being the foundation or basis of success, and good management the superstructure. They go hand in hand; and whenever the intelligent bee-keepers of this country adopt and use larger ones, they will be utterly astounded at their former blindness in this matter.

A queen bee lays about 2000 eggs every day in the height of the season. She lays as many in a small hive as she does in a large one: but in a small one there are not empty cells for 500 eggs a-day; and therefore 1500 eggs are destroyed in some way every day. The bees must either eat or cast them out. Now, suppose the bees were allowed room to set and hatch all these eggs, how much more numerous the population of the hive would be, how much more honey would be collected, and the swarms or colonies sent off would be better too.

On former occasions, when we have been trying to make bee-keepers *think*, we asked them to consider the folly of a farmer's wife expecting large eggs from bantam hens. And we ventured to predict that if Shetland ponies only were used by farmers, agriculture would speedily collapse —nay, it would never have been advanced to its present state, commanding the energies of our best men. Without the muscle and strength of the fine horses of the Suffolk,

Clydesdale, and other breeds, what would agriculture have been? Would it be worth the attention of men of skill and energy? So it is, and so it will be, with bees kept in small hives. They are hardly worth the attention they require, and the profits from them will never call out that enthusiastic energy and latent power which, put into play, makes the most of everything. Of course apiculture is a thing of trifling importance to agriculture; but we hold that the general adoption of large hives will bring about a reform and revolution in bee-management, that will confer large and lasting blessings on the rural population of this and other countries.

But let us return once more to the hives which weighed from 100 lb. up to 168 lb. Why, it would take three ordinary English hives, if not more, to hold as much honey as was in one of these hives—it would take three or four of them to hold bees enough to gather as much in the same space of time.

It is not necessary to say half so much in favour of large hives to minds unwarped and unprejudiced; but as almost all writers on bees, ancient and modern, have recommended hives *unprofitably* small, we have the hard and painful task to perform of nullifying, in some degree, the influence of their opinions, ere we can successfully recommend the general adoption of hives profitably large.

It is well known that, in very fine seasons for honey, there are considerable profits derived from the produce of small hives: we know this very well. But we wish the reader to know that in such favourable seasons, the produce and profits of large hives, well managed, are incomparably larger. The writer's father once realised £20 profit from two hives in one season, and £9, 12s. from another held jointly by himself and James Brown of the same place. And the profits came from the honey

gathered by the bees, not from swarms sold at an exorbitant price, a practice common in our day.

The question of sizes and shapes of hives we now come to consider. Three sizes have been recommended, namely: first, 20 inches wide by 12 inches deep, inside measure; second size, 18 inches wide by 12 inches deep; and the third size, 15 inches wide by 12 inches.

The first size contains about 3000 cubic or square inches; the second size, about 2700 cubic inches; and the last, about 2000 cubic inches. We say *about*, for hives are sometimes made more convex or round in the crown, and when this takes place, the cube measure will be lessened somewhat. It is not expected that bee-keepers will be guided to the adoption of hives corresponding exactly with the sizes given above, but it is hoped that they will adopt and use hives, after their own models, equal in size to the second and third mentioned above. Three years ago, I ordered in Scotland 60 hives of the above sizes; but an old uncle who got the order did not comply with my wishes, for there were not two of all he made for me of one size. Last year we got 28 made to order in Ayrshire, 24 of them are 18 inches wide, 12 of which are 12 inches deep, and 12 are 14 inches deep. This winter we have sent an order to the same man for 48 hives of the same sizes. For convenience' sake we shall cleave in future to these sizes,* for by using hives exactly one width, ekes for enlarging them will always fit the hives without having to be altered. These hives will often need enlarging in good honey seasons; and where supers are used, eking below will not be necessary. This process of eking is mentioned now with a view to let the reader see the wisdom of fixing on certain sizes for his hives—at least the width of his hives—so that enlargement may be easy when necessary.

* 18 and 16 inches wide, and 12 deep.

A hive 20 × 12, well filled, will weigh about 100 lb.; one 18 × 12, 80 lb.; and the 16-inch hive will weigh about 50 lb. These figures are meant to give the reader an approximate idea of the contents of the hives recommended. In the months of May and June, the hives would be at the swarming-point before they reach the weights here mentioned, and in the autumn of favourable seasons they would probably go beyond these weights without the bees ever thinking of swarming. But we want to know a little of the capabilities of these big hives. How much honey can they gather in fine weather per day? That greatly depends on the state of the atmosphere; for soft warm winds from the west and south fill the nectaries of flowers with honey, whereas winds from the east and north seem to stanch the flow of honey almost completely.

Well, but on good pasture, and with favourable weather, a 20-inch hive, well filled with bees, will gather from 4 to 10 lb. per day; the 18-inch hive, from 3 to 7 lb. per day; and the 16-inch hive, from 2 to 4 lb. per day. Here, again, a great deal depends on the number of empty cells in a hive, and the quantity of brood that requires attention.

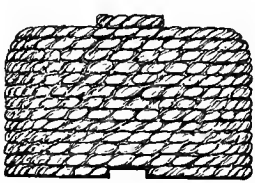
We have known, as already stated, one hive only that gained 10 lb. in weight per day. It was placed in the midst of good pasture, when it weighed 39 lb. It rapidly rose in weight to 109 lb., and in two days it gained 20 lb., besides keeping itself. The traffic of bees going out and in of this hive, while gathering so much honey, was graphically described to resemble the steam of a tea-kettle going two yards from its mouth before vanishing amongst thin air. But it is good work for a hive to gather from 3 lb. to 5 lb. per day, and this is of frequent occurrence where large hives are kept.

But why use the smaller size at all when we see that the 18-inch hive does more work of every kind? We are

glad this question has been mooted, for it gives us the opportunity of saying that hives of two or three sizes are of great advantage to a bee-keeper who acts on a principle, sound and natural, and with his eye constantly open to his own interests.

All seasons are not alike favourable, and all swarms are not equally large, and some are early and some late in leaving their mother hives. When we come to the chapter on swarming, instructions will be given as to which size of hive will be best for certain swarms and seasons, but half a word to the wise is enough.

The shape of hives may be rather conical at the top, or flat crowned. It is a matter of taste and convenience this. Some bee-keepers like the one sort and some the other; and some skep or hive makers can produce or build a hive each after his own pattern only. We have been accustomed to the use of hives rather flat in their crowns, and we prefer them to the hives with conical crowns.



Here is a straw hive 18 inches by 12. Its sides are nearly perpendicular; its crown nearly flat. It has an opening 4½ inches wide in the crown for a super, and a lid to cover that opening when supers are not required. The 16-inch hives are made after the same fashion—all with holes in their crowns for supers of honeycomb. A well-made 18-inch hive weighs when empty about 5 lb., and a 16-inch one about 4 lb.

When an 18-inch hive receives an eke—say, 4 inches deep—it will measure 18 × 16, and contain nearly 4000 cubic or square inches of space. Now, tell us if a hive of such dimensions, well filled with combs, will not overtask the laying powers of a queen bee? No; we have seen larger hives as full of brood as the smallest hive in the country ever was.

Before we leave the question of sizes, let us warn our readers not to be too hasty in introducing the large sizes into their apiaries. Begin with the 16-inch hive, and never purchase one less. The second year the swarms from these will be able to fill the larger sizes.

THE MATERIALS OF HIVES.

Straw hives, well sewed with split canes or bramble-briers, are incomparably better for bees than any other kind of hive yet introduced. Nothing better is needed, and we believe nothing better will ever be found out. On the score of cheapness, neatness, lightness, suitability, and surpassing worth, we advise all bee-keepers to use nothing but straw hives as domiciles for their bees, if their aim be to get honey and profit.

Where straw hives cannot be obtained, wooden boxes are used; but they are very objectionable in every sense, save, perhaps, their durability.

Hives made of wood, at certain seasons condense the moisture arising from the bees, and this condensed moisture invariably rots the combs. The walls of a wooden hive are often like the walls of a very damp or newly-plastered house. The outside combs, and sometimes the centre combs too, perish before the wet walls of these wooden hives. They perish in this sense, that their

nature or adhesive power goes like mortar in walls, and becomes as rotten as a piece of burnt paper. All such rotten combs are worse than useless in hives, for they have to be taken down and fresh ones put in their places. There is in this work of the bees a waste of both time and honey.

But how can we account for the use of boxes as bee-hives in this country at all? The great bulk of straw hives of English make are exceedingly small and ill made, and are really not fit to be used as bee-hives; comparatively, they are not worth one shilling a-dozen. Well, many bee-keepers finding them very unsatisfactory, and unsightly too, have invented hives of wood. Of course everybody loves his own offspring, and likes to see it bear a good name, and be recognised in society. Every invention is a grand affair! Both architect and builder join hands in supplying the world with an article decidedly superior to all that has gone before! And what was begun in honest effort ends in full-fledged quackery. And hundreds, ignorant of bee-science, are induced to purchase these costly hives, which, in their own turn, are found so unsatisfactory, that the purchasers think that they will never be duped again. Another invention turns up in the shape of a costly hive—to be managed on the "depriving" or humane system! Many, again, are bewitched by the very name of the last invention, and ignorantly spend their money for hives which the writer would not accept as a gift.

It appears from Mr Quinby's book on bees, that in America the new inventions in bee-hives are more numerous than they are in England, and are well patented and patronised. He says, after showing the worthlessness of many patent hives, "that in Europe the same ingenuity is displayed in twisting and torturing the bee,

to adapt her unnatural tenements, invented not because the bee needs them, but because this is a means available for a little change. 'Patent men' have found the people generally too ignorant of apiarian science. But let us hope that their days of prosperity, in this line, are about numbered."

Mr Quinby, who is one of the most enlightened and common-sense bee-keepers living, knows well, that where profit is the object, common hives are the best. If we were to give full expression to our opinion of the various kinds of hives now being sold in this country at exorbitant prices, who would venture to protect us from the hurricane of abuse that would be poured upon us?

Hear what Mr Quinby says: "We have faithfully supported a host of speculators on our business for a long time; often not caring one straw about our success, after pocketing the fee of successful 'humbuggery.' One is no sooner gone than we are beset with another with something altogether different, and, of course, the acme of perfection."

In making these statements and quotations, we know that the prejudices of some of our readers will be offended. We are sorry for this, but we cannot help it; we like to be honest.

To have done, let me again say that well-made straw hives of considerable dimensions are better than wood hives of any description; better for the swarming system of management, and better for the non-swarming; better for comb-building and better for honey-gathering; better for health and better for ventilation; equal in every way to wood for supers, better for nadirs, better for winter, and better for summer.

I am not aware that good skeps (straw hives) are made in England; hence my order goes to Scotland, through Mr

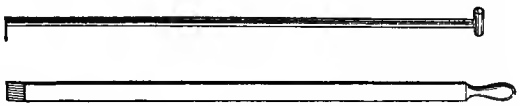
Samuel Yates, seedsman, 16 and 18 Old Millgate, Manchester, who has found out two parties in the west of Scotland who make excellent hives. Mr Yates, last year, ordered some dozens for selling in his shop, beyond the twenty-eight he got for me. They were all speedily sold, and this year, I believe, he intends to order more largely. I have no interest in the sale of this or that hive; but merely mention where and how I obtain mine, that the reader residing near Manchester may know where to find well-made straw skeps in the event of his wishing to do so.

Where these cannot be bought, wooden boxes will have to be used. The wood of such boxes should *not* be planed on the inside, for bees cannot hold by, or walk on, smooth surfaces. Such boxes should be 15 inches square and 12 deep for first size, and 10 inches deep for second size, all with holes, 4 inches in diameter, in their crowns, for honeycomb glasses or boxes. The boxes should be well made of wood, three-quarters of an inch thick; but all expense in the way of ornamentation will be lost. For any extravagance in this line the bees will not render thanks, or return one penny of interest for the outlay.

THE BAR-FRAME HIVE.

Do you approve of this hive? No, for it is very inconvenient, clumsy, and expensive. We do not see one feature in a bar-frame hive which will commend it to an experienced bee-keeper, whose object is boney and profit. We believe it will soon go into disuse. We would abandon bee-keeping for profit if we were compelled to use hives filled with bar-frames. They would be a perfect nuisance to us. But are they not useful to some bee-

keepers who like to get a bar of honeycomb now and then? Perhaps they are; but anybody may get honeycomb from a common hive more easily than from a bar-frame one. By using comb-knives, he could cut out of a common hive 2 lb. or 4 lb. or 6 lb. of honeycomb about as soon as he could unscrew the lid or top of a bar-frame one.

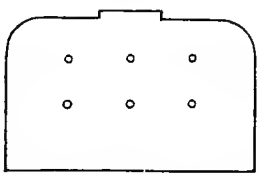


Here are two tools used for cutting combs out of hives, and which are exceedingly handy when we want a few pounds of honeycomb. They are useful on more occasions; but they are introduced here to the notice of the reader, merely to let him see that movable bars in a hive are not at all necessary for the purpose of obtaining a comb of honey.

The broad tool or knife is simply a piece of iron or steel, with a chisel end, for cutting the combs from the sides of the hive, and for splitting them elsewhere. The other is a rod of steel, rather more than a quarter of an inch thick, with a thin blade at the end $1\frac{1}{2}$ inch long—both edges sharp—for cutting the combs off at the top of the hive, or crosswise anywhere. These knives should be from 20 to 24 inches long.

But do you not consider the bar-frame hive very useful to the student of bee-history? Yes, very; for he can take out a bar of comb and examine the brood in it daily, or as often as he chooses. The bees do not always make their combs in the line of the bars; and when they do so, the bars are not movable without great sacrifice. And while the combs in a bar-frame hive are not wholly made,

it is rather dangerous to move it, for there are no cross-sticks in these hives to steady and support the combs. Till the combs reach the bottom, there is great risk in moving these hives. A slight shake or blow may cause all the combs in them to fall down in confused masses. Woodbury's bar-frame hive is made principally of straw, and is therefore incomparably the best of its kind. Now, in common hives, cross-sticks are used with great advantage and safety. We use five or six in every hive. These cross-sticks go from side to side, and, by the use of guide-combs, the combs are made to run from front to back, so that every comb is well supported.



Before the combs are well started from the crown of the hive, they are securely fastened to the top centre stick; and as they are enlarged they are cemented to the other sticks. The bottom sticks should be at least *four* inches above the board, for if less than four inches the bees sometimes do not close their comb round them.

GUIDE-COMBS.

These are simply little bits of clean old comb (the older the better) about two inches wide and one or two inches deep, fastened to labels, such as are used for naming plants. Well, the bit of comb and label are laid together, and fastened by dropping between them a little melted

wax. This is best done by holding a warm poker over the two, and touching it with a bit of wax. The poker should just be warm enough to make the wax drop. If the poker be too hot the wax will boil, and melt the guide-comb as it falls. When the wood and comb are thus cemented together, the wood is nailed in the crown of the hive—that is to say, fastened by pinning with nails, guiding the bees to build their combs running from back to front. When the combs are so made, the bees can see the door from the centre of the hive, or anything going in at the door, which they could not do if the combs ran from side to side. But as the sticks run from side to side, the combs are well supported, and will bear removal from the Land's End to John-o'-Groats without injury. Another advantage of using sticks in hives is this, that the bees, being great economists, use them for cross-lanes. Where the combs cross the sticks, and are fastened to them, the bees leave little holes or doors in the combs, which they use as passages from comb to comb. They thus get shorter journeys for indoor work. In hives without sticks, such byways and convenient passages are very rare indeed.

I may now be excused for saying that it has pained me exceedingly to say some things in this chapter on hives; for I know they will touch the prejudices and stir the feelings of some bee-keepers whom I do not wish to offend. But if I had not said these things, my own conscience would have condemned me for withholding from a work on the profitable management of bees the deep-seated and honest convictions of my own mind. One gentleman, a manufacturer of hives, has written to me to say, that he will give me much information on bees if I will only publicly mention "his ten-bar frame hive." Poor fellow!

THE LEAF OR UNICOMB HIVE.

This is "the hive" in which to see bees at work. No other hive is to be compared to it for observation. And it appears to us that no other is necessary.

In this hive every bee, and all it does, can be seen, and all the movements of the queen can be noticed and watched. A common hive with glass windows is all but useless for observing what goes on inside. All that can be seen in them are some combs and bees next the windows. But when there is only one comb with glass on each side of it, there is opportunity given for witnessing the internal operations of a bee-hive. As the unicomb hive is not meant for honey or profit, I need say little about it. To those engaged in the investigation of the habits of bees, we strongly recommend the use of unicomb hives.

CHAPTER XVIII.

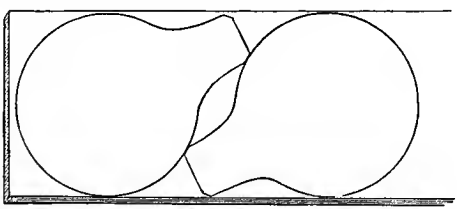
BOARDS.

Boards should be about 1½ inch wider than the hives standing on them. They are best when made of one piece, that is, without a seam of junction; but if they cannot be cut whole from a deal board wide enough, they can be made of two pieces well joined. But whether of one piece or two, it is necessary to nail two bars on the under side of each board, to keep it from warping or twisting. The wood of which they are made should be either ¾ or 1 inch thick. A good board weighs 4 lb.

The flight-board should be seven inches in diameter. Small flight-boards are objectionable, for the bees returning with heavy loads often miss them. This is not all; for bees require *breathing* room at the doors of their hives, as well as a good broad landing-stage. All birds and insects fill their bodies with air before they take wing. A pheasant hops while he is filling his body with air; a pigeon does it by taking two or three inspirations. If the pheasant is suddenly disturbed, and has to rise without hopping a bit, he does rise, but so heavily and slowly—with a great cackling noise—that he is often knocked down by the shot of the sportsman ere he gets a fair start. If bees have a broad flight-board they run like the pheasant; but if the board be small, there is often at the doors of strong hives a crowd and a crush and a want of free-

dom, such as are seen and felt by large congregations in leaving a church. If the board and the door of a hive be wide enough, the bees go out and off without hesitation. They never loiter, and it is a pity the ignorance of their owners should ever compel them to do so.

The beautiful gush or stream of bees in the act of swarming is owing to the fact that their bodies are so full of honey that they cannot rise on wing without first filling their bodies with air; and in doing this they run nearly to the point of the flight-board.



Two Boards marked for sawing out of Deal or Plank.

THE DOOR OF THE HIVE.

Some bee-keepers have channels cut in the boards for doors. Where this is done, the flight-boards are uneven and unlevel; but the hives are unbroken or uncut in any way. As we like the flight-boards pretty even, and some playroom on them, we prefer the doors cut in the hives. About 4 inches in length of the bottom roll or round of a straw hive cut clean out makes a fine spacious doorway. The door will be thus 4 inches long and 1 inch high, which is little enough for strong hives in the busy season.

Our system of feeding, which will be mentioned hereafter, requires the flight-boards to be level, and the doors

to be made through the bottom rolls of the hives; but as far as honey-gathering goes, it is of trifling importance whether the boards or hives be cut for doors. Only let them be large enough, so that the bees may *lave* and *ladle* the honey through them into their hives.

At the end of the season the doors are contracted very much, and remain so all through the winter months.

CHAPTER XIX.

COVERS FOR HIVES.

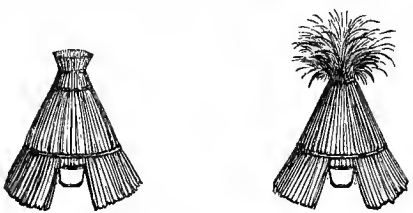
In summer as well as winter hives require protection. If not shaded from the summer sun, the combs are likely to become softened at their fastenings, and drop down in a confused mass. The rays of the sun should be warded off by coverings of some kind. And it is well when not a drop of rain can touch hives, either in summer or winter. Of course, rains in summer that touch hives do less harm than in winter, inasmuch as the wetted parts are sooner dried in hot weather. It may be stated as an axiom that perfect protection of hives, from both sun and rain, should be aimed at in covering them.

Milk-pans are in common use in many parts. With small hives they answer in summer, but they are a miserable protection in winter. For cheapness and convenience, anything *at hand* that will shed the rain off hives in summer is made use of. Three or four cabbage-blades placed on a hive, and held there by a stone, are often used till something better turn up. We now use felt (sold at one penny per foot) largely as a covering for hives. It is impervious to water, and very durable; indeed I cannot yet say how many years it will last. The covers of felt that I got four years ago are as good as ever they were, and apparently will last for an indefinite length of time. These felt covers suit us well, for they

are very light, soft, and pliable, and can be carried about in small compass. When we remove our bees to gardens in the country, the felt covers go with them; and when we remove them to the moors, we find it more convenient to take them for covers than it is to cut peat-sods on the spot where the hives may be set down. Another inducement to us to use these felt covers is that they are not very conspicuous; and this is a consideration to us, if not to other people, for we are glad to get permission to set a few hives down in any *odd* corner, even at a distance from any human abode.

These felt covers are rather thin for a burning sun; hence it is wise to place a little hay, or heather, or grass, or rags between them and the hives.

Sods cut off peaty land and dried, are impervious to wet, and make excellent summer coverings. But straw coverings are incomparably the best of all—best for summer as well as winter; and they look better than anything else I have seen used as covers for hives. When a farmer's corn-stacks are all well thatched and nicely clipped, they not only please the eye, but convey to the mind of every passer-by the idea of comfort, and also that his profits will not go into the wrong pocket. A row of well-thatched bee-hives in a cotter's garden is calculated to please the eye, and breed pleasant thoughts to the mind.



Straw Covers.

These are simply made, by tying one end of a bunch of straight or well-combed straw with tarred string, dipping them in water before placing them on the hives, hooping them on, and then clipping them neatly. When put on wet, they set, and stiffen to fit, and may be lifted off and on like a man's hat. When well made they last two years. As hives, out of doors, cannot be kept too warm in winter, the reader will, in another place, be urged to protect his bees from the cold of the winter storms, by giving them not only a good outer covering, but plenty of *under flannels.*

Thousands of hives are starved to death for want of food, and thousands more for want of sufficient winter covering.

CHAPTER XX.

STINGS.

If bees had not been furnished with weapons of defence, the probability is great that they would have been destroyed centuries ago. The treasures of a bee-hive are so tempting to men and brutes, birds, and creeping things, that it has been necessary to provide bees with a means of defence; and this is done by giving them stings and bags of poison, which they can use at will. When they receive or anticipate molestation they are not slow to make use of their "poisoned arrows;" and every arrow is barbed, so that, if inserted, it sticks fast—so fast that it drags or tears the venom-bag attached to it from the body of the bee. And after separation from the bee, the sting is moved by a self-acting machinery, intended, no doubt, to empty the entire contents of the venom-bag into the part stung; hence the wisdom of withdrawing a sting as soon as it is inflicted. The pain and probable inflammation will be greater and longer continued if the sting be not extracted at once.

Some people are much disfigured by being stung on the face; and the question has been asked, If these people were frequently stung, would the stings continue to have as great influence? We cannot answer this question with certainty, though we have known men who suffered great inconvenience from stings in early life, disregard them

after a time; at least the swelling or inflammatory power of stings was comparatively lost on them.

Those who are liable to swell much on receiving a sting should wear a bee-dress when likely to be attacked by bees, or when doing anything among them. A bee-dress is simply a piece of crape or muslin tied above the brim of a hat, to hang over the face, and some inches below the chin. The other parts exposed are the hands only, which can be protected by gloves. Fortunately we ourselves do not suffer or swell much on being stung, and therefore never use a bee-dress of any description. When bees attack one, or mean to do so, the hands should be spread in front of the face—or, better still, a bush held before it —then walk slowly away. When the bees see the fingers or bush they are afraid of an ambuscade—as sparrows are kept from gooseberry-buds by the use of thread.

CHAPTER XXI.

FUMIGATION.

This is a grand invention—how long it has been practised I cannot tell. About sixty years ago, when selling honey in Edinburgh, my father met an Irishman, who undertook to teach him how to carry a hive of bees, open and exposed, through the streets of that city without receiving a single "*stong*," for a gill of whisky. Far too tempting an offer this to be rejected by my father. He got the secret, and, I presume, the Irishman got some whisky for it. The secret was worth all the whisky in Edinburgh; for ever since we have been enabled to do what we like with our bees without risk or fear. Smoke from the rags of fustian or corduroy, blown into a hive, is the secret bought from the Irishman. A few puffs of smoke from a bit of corduroy or fustian rolled up like a candle, stupefies and terrifies bees so much, that they run to escape from its power. Tobacco-smoke is more powerful still, but it has a tendency to make bees dizzy, and reel like a drunken man; besides, it is far more expensive and less handy than a bit of fustian or corduroy. Old corduroy or fustian is better than new, unless the matter which is used to stiffen it be completely washed out. This stiffening matter won't burn—won't let the rags burn; hence we use and recommend old stuff which has lost it. The old worn-out and cast-away fustian and corduroy

clothes of labouring men cannot be surpassed for the purpose of stupefying bees. Let me ask the most timid bee-keeper in the country to try it. Get a piece, the size of a man's hand, rolled up rather tight and fired at one end —not to blaze, but simply to smoke. Let him now place the smoking end so close to the door of a hive that all the smoke may go in when he blows on it. After six or eight puffs have been sent into the hive, let him lift it off the board, turn it gently over, upside down, so that the bees and combs stare him in the face. By holding and moving the smoking end of the rags over the face of the bees, and blowing the smoke amongst them, they run helter-skelter down amongst the combs, far more afraid than hurt. Now he can carry the hive round his garden under his arm, and then carry it round the house, and over it too if he choose, without being stung. Whenever the bees are likely to rise they should be *dosed* again.

If the reader has hitherto not dared to handle his bees in this manner, we ask him to try the experiment, believing that he will be more than satisfied with the result, for he will find that he has now got the mastery over his bees, and can do what he likes with them. Yes, he will be able to drive them out of a hive full of combs into an empty one, and, moreover, shake them back, or tumble them back, or spoonful them back, into the old hive or another, as men take peas from one basket to another, Nay, he will be able, after another lesson, to swarm his bees artificially, and thank the Irishman for revealing the virtues of corduroy-smoke.

This smoke does not injure the health of the bees, does not stop them from work more than two or three minutes. The material of it is cheap and comeatable; the use of it is so easy and simple and efficacious, that we have no wish to find anything better for stupefying bees. Old calico

rags or strong brown paper may occasionally be used as substitutes; but they are so apt to blaze that no bee-keeper who can find a piece of fustian will use them.

Chloroform or puff-ball may sometimes be used by experienced men to produce the complete prostration and stupor of a swarm—*i.e.*, all the bees in a hive—for a short time; but the use of these things is dangerous and quite unnecessary.

CHAPTER XXII.

WHETHER IS THE SWARMING OR NON-SWARMING SYSTEM OF MANAGEMENT THE MOST PROFITABLE?

THIS question is of great importance, and will be considered as fully as our limits will permit. The swarming system of management is not only more profitable, but, taking a run of years, is better every way, and more natural, than the system that prevents swarming.

One bee-keeper in the neighbourhood of Manchester who writes on the subject, once said to me that "honey and swarms could not be obtained from hives in the same season." I venture to express a contrary opinion. Now, during the last three years my best swarms every year have risen in weight to 70 lb. each, and sometimes more, whereas his non-swarmers have not approached that weight —nay, my old stock-hives, after yielding one and two swarms each, have been as heavy as his, which never swarmed at all. All this has not been owing to their being allowed to swarm, but partly to the size of the hives and our system of management.

But after making many trials we can state that in good seasons for honey, a good early swarm will, at the end of the season, weigh more than a hive that has never been permitted to swarm at all. A swarm put into an empty hive is doubtless placed at a great disadvantage, and

apparently will never both fill its hive with combs and gather as much honey as the old one already full, weighing perhaps 30 lb. or 40 lb. But wait a little: the swarm which is far behind during the first ten days, afterwards rapidly gains upon the old one, and generally overtakes it when they are both about 70 lb. or 80 lb. each; the young one now goes ahead, at the rate of 2 lb. for 1 lb. And, besides the great superiority of the first swarm over the hive which did not swarm, there are the mother hive and probably a second swarm, weighing by the end of the season from 40 lb. to 80 lb. each. Of course these weights will not be gained in seasons not remarkable for honey-gathering; and in unfavourable years, when bees have to be fed, the fewer hives we have the better,—as, in times of calamity, or famine, or want of work, the working classes of Manchester and other cities find it cheaper to give up house and take lodgings—two or three families swarming into one house, instead of each family paying rent for a whole or separate house. But, even in ordinary seasons for honey-gathering, the swarming system is by far the most lucrative.

If asked to explain how it is that swarms put into empty hives gather more honey and do better than hives not weakened by swarming, we might not be able to do so satisfactorily; neither can we explain how it is that a spring-struck verbena grows more vigorously and does better than an autumn-struck one. As with verbenas so with bees: young ones do better and run quite ahead of old ones.

However, we may venture to guess, or give our opinion, as to the reasons why good early swarms of the same or current season outdo those that never swarm at all.

1st, The stimulus of an empty hive makes the bees work harder. In the absence of combs, all the eggs laid

by the queen are lost. Combs *must* be built to hold both honey and eggs. For the first two or three days, the greater part of the honey gathered is eaten by the bees *with a view* to secrete wax for comb-building, which goes on with marvellous rapidity. Liebig thinks that it takes 20 lb. of honey to make 1 lb. of wax; but let us suppose that 2 lb. of wax is manufactured from 20 lb. of honey. Now, in good-sized hives there are about 2 lb. of wax. We have known a swarm fill, or nearly fill, its hive with combs, and gain about 28 lb. weight in ten days. What a stupendous amount of work these young colonists performed in ten days! Young swarms work harder, apparently, than older ones.

2d, The combs of swarms are clear and free from a superabundance of farina or bee-bread; therefore the cakes of brood will yield a young bee from every cell, making the hatch of the swarm considerably larger than the old hive. By the end of the season a swarm is much more populous than the other which we have been comparing with it. Even a second swarm, in honey years, will sometimes pull itself abreast the stock or mother hive, with a weight of 30 lb. to gain.

By swarming we double and often treble the number of our hives annually, and therefore have two or three queens laying instead of one. By-and-by it will be seen more clearly how invaluable these additional swarms are to a bee-keeper; and, therefore, the superiority of the swarming system over the non-swarming one.

3d, By the adoption of the swarming mode of management we can change our stock of hives every year; that is to say, we can set aside one of the swarms for stock, and take the honey from the old one and other swarm, and thus our stock is full of new sweet combs, and free from foul brood, which is a great advantage. No hive

should be kept more than two years, as old combs are objectionable for many reasons, and ugly to look at.

Besides all these considerations, there is, in the swarming system well carried out, the CERTAINTY of success in bee-keeping. On the non-swarming system, hives are comparatively weak in bees in early spring; whereas, on the swarming system (as we recommend it to be done), the hives are of great strength and power even in early spring. And we maintain that ten strong hives will do more work than twenty-five weak ones. How does the swarming system secure strong hives? In this way: the bee-keeper has one and often two swarms to spare for every hive he selects for stock in autumn. This selected hive for stock gets the one or two extra swarms united to it, and thus becomes doubly or trebly strong. Hives of such strength are well able to face the difficulties of a severe winter—difficulties that often crush and kill weak ones; and when spring arrives, these strong hives gain weight fast, and are ready to swarm a month earlier than those that had no additional bees given to them in the autumn. In this neighbourhood bees do not gather much honey after the apple-blossoms fall, there being scarcely any white clover near enough. If the hives are weak in bees they gain but little from fruit-blossoms, which are so rich in honey, simply because they are not strong enough to do much work; but when made strong in autumn by the addition of extra swarms, they gain here, off the fruit-blossoms, in fine weather, from 3 lb. to 5 lb. per hive.

4th, On the non-swarming mode of management the queens become old and die; and at the time of the death of a queen there is a loss sustained. The hive in which she dies is without eggs for three weeks, or thereabouts; for ordinarily the young queens are not matured

till about ten days after the old one dies, and it is ten days more before she begins to lay. But there is the risk of the loss of the whole, for if the queen dies when she is not laying, the bees cannot raise a successor.

Now, in the swarming system, the bee-master may have nothing but young queens in his hives, by destroying the queens of the first swarms when the bees are united in the autumn. We hope we have made this matter so plain and simple that none will misunderstand our meaning. If the bee-keeping reader is seeking knowledge on the question before us, we trust he begins now to feel his feet touching pretty solid ground.

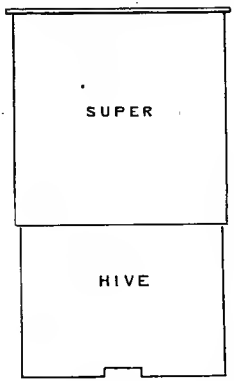
But some bee-keepers say, "We don't want swarms; we want supers of honeycomb: it is not an increase of hives, but an increase of pure honeycomb we are aiming at." And the question may be urged whether the swarming or non-swarming system is best for getting most supers of honeycomb. At present we could not answer this question with any degree of certainty, for we have not tested it by experiment. And even if fairly tested by actual experiment in one season or locality, the same experiment in another locality or season may produce different results. We are strongly inclined to believe that the swarming system will yield more supers than the non-swarming one, if the bee-keeper understands his work, and earnestly sets his wits to the task of getting all the supers possible. But tell us how you would set your wits to the task of getting supers and swarms too? Well, we would have our hives well filled with bees in autumn, as already described. They would be ready to swarm very early in May; but before they were ready to swarm we would put a super to hold 8 lb. or 10 lb. on each. If the weather permitted, and the hives did not swarm, these supers would be filled in fourteen or sixteen days. After

cutting the supers off we would swarm all the hives artificially—that is, a swarm from each hive would be taken off and put in a 16-inch hive, which is the smallest size we use. The stock would be left full of brood, with sufficient bees to hatch it. On each a super should be placed, for every day the populations of the hives would be augmented by the brood coming to perfection. Probably no combs will be made in the supers for ten or fourteen days, when second swarms may be expected to issue. When these second swarms are thrown off, the best way is to throw them back on the front of the hives whence they came. They creep into their hives and rarely come a second time. The hives are now full of bees, with no brood to feed or attend to. At this time the bees generally gather a great deal of honey, and will fill supers, weather permitting. I know an experienced bee-keeper who succeeds thus in obtaining supers from hives which do not throw off second swarms. In about three weeks from the time the first swarms were put into the 16-inch hives, supers should be placed on them—that is, if the weather has been at all favourable, for they will then be full of combs with brood coming to perfection every day. These young swarms will not be long in filling their supers from the fields of white clover now at their best. Here we see the likelihood of having three supers from one hive managed on the swarming system. With two strong hives in the middle of July, there is left the probability, if not the certainty, of getting a super of honey from each of them before the season closes. If the season be favourable, all this may be done under good management. Then there will remain a hive of honey for further profit, the bees of which will be united to the other, to be kept for stock; and this stock will be incomparably better for keeping than one that has never swarmed at all.

It were easy to suggest other ways of obtaining supers of comb on the swarming system. The great difficulty in obtaining supers is the tendency of the bees to swarm; and this difficulty is greater by half in the non-swarming system of management, for it is the nature of bees to colonise, and therefore great care is necessary to prevent hives from casting off swarms when supers on them are nearly full. In the hands of ignorant people, hives that have received supers often swarm before a bit of comb is built in them.

On the conviction that it is a waste of material and loss of time to make swarms fill empty hives, the non-swarming system has been introduced in every shape and form, and generally introduced with the assertion that more honeycomb will be obtained. In certain seasons it is well known that a great deal of pure honeycomb has been yielded by hives managed on the non-swarming mode. In 1863 Mr George Fox of Kingsbridge, Devonshire, got from two hives two glass boxes (or supers) of pure honeycomb, weighing respectively 109½ lb. and 112 lb., their gross weights being 123 lb. and 126 lb., but the empty boxes were 14 lb. each. These magnificent supers and results seem to throw into the shade all other results of bee-keeping. But in the same year Mr Fox got "an octagon box of fine white comb," which weighed 93 lb. 4 oz., from a swarm of June 28, 1863. Here is a late swarm yielding a super 93 lb. If the swarm had come off four or six weeks sooner, which is the usual time, the probability is great that it would have overtaken and outrun those that never swarmed at all. Well might Mr Fox say, as he does in a letter before us, "These glasses were exceedingly beautiful, but the risk and fatigue of removing them were great; and as I never like to ask assistance, in case of an accident, I had to exert myself too

much. And I assure you it was no joke carrying about those 126 lb. and 123 lb. glasses, and some little difficulty in getting the bees to leave them."



Mr Fox's supers were filled on the *adjusting* principle. The above sketch will enable the reader to form a pretty correct idea as to the way in which it is carried out, and how Mr F. succeeded in inducing his bees to fill so large glasses. The supers fitted or slipped over the outsides of the hives, and were let down so far that their crowns were not far from the crowns of the hives. The bees had not far to go to make a commencement in them; but as soon as the combs came down, the supers were raised bit by bit till they were filled. The sides of the supers being glass, Mr Fox could see when to raise them. He says: "The season of 1863 was better for honey than any of the twelve years going before; but, notwithstanding, such large fine glasses of honey could not have been obtained, except by working the hives upon his adjusting principle." Kingsbridge, too, he says, is a good place for bees; and we add this remark, that it has an able man to manage them.

Supers about 10 lb. weight are most readily sold. We got one 22 lb. weight from a swarm last year. From the non-swarmers, supers are got by cutting them off as soon they, are full and putting empty ones in their places to be filled.

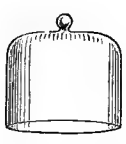
Both systems of management could be well carried out in the same apiary. Suppose the owner has ten stock-hives, five of which are permitted to swarm, and five prevented from swarming: the non-swarming hives would be greatly helped and strengthened by receiving extra swarms in autumn from the others.

We conclude this chapter as we began, by saying that, with an eye to profit, we greatly prefer the swarming mode of management. Hives that do not swarm are often affected and made useless by that awful and incurable disease of "foul brood."

CHAPTER XXIII.

SUPERS.

THESE are made of straw, wood, and glass. Straw skeps, small and neatly made, are better than small boxes for supers. Honeycomb in them sells in the wholesale market at 1s. 6d. per lb. Glass supers filled command a higher price. The straw and box supers are more convenient for parties using their own combs; but glass supers are ornamental on a dinner or breakfast-table, and therefore more saleable.



Common Honey-Glass.

Improved Honey-Glass.

It will be seen that one glass is a very great improvement on the other; it looks better, and has a movable top or lid. In glass supers the combs are generally built upwards, and when they reach the tops they are fastened to them. When the improved glasses are filled and taken off, the lids are found securely fastened to the combs. By dipping a towel or cloth of any kind in warm water, and then laying it on the lids, they become unfastened, and

can be lifted off and on without breaking a single cell. The combs can then be cut out from the top.

When supers are full, the sooner they are taken off the better. They are severed from their hives by drawing a piece of fine wire or string between them. Of course this wire cuts every cell in its way, leaving the cut parts wet with honey. In order that these cut wet parts may be quite clean and dry when the supers are taken off, we raise them three-eighths of an inch by wedges, so that the bees can more easily lick up the honey from the broken cells. They do this very cleanly in about one hour. Some people leave them on the hives for ten or twelve hours after they have been cut and raised. No harm can be done by letting them remain twelve hours, if the bees do not begin to carry the honey *down-stairs*—that is, out of the supers into the hives.

There is sometimes a little difficulty experienced in getting the bees to leave the supers. Our best friend and greatest helper in this work is the old corduroy, the smoke of which should be blown vigorously into the super from the top before it is lifted from the hive. The bees are thus hastily driven down below. The super should be removed at once to a place where bees cannot *come to steal.*

Glass supers require a good deal of *warm clothing* while being filled, for the bees like both warmth and darkness. Bees will not build combs in glass supers, or even remain in them, if they are not warmly covered.

CHAPTER XXIV.

EKES.

Can bees be prevented from swarming? Yes, by the use of ekes; and what are these? Additions or enlargements from below—that is to say, eked or lengthened. Four or six inches stitched to the bottom of the legs of a pair of trousers is eking: the legs are thus made longer. So hives are enlarged or eked by the use of riddle-rims, or four or five rolls of hives about the same width as the hives raised by them. These ekes are fastened to hives by nails or staples going into both, and the junctions covered with fresh cow-dung, which speedily hardens and cements the two together.

Straw ekes, like straw hives, are much better than wooden ones. At present we use riddle-rims for eking because we have none of straw. The sides of a hive nearly worn out make two ekes, if properly cut and sewed a little.

Are ekes better than supers for getting a great weight of run honey? Very much; for bees can put more than 3 lb. of honey in ekes for every 2 lb. they can put in supers. Bees not only gather more honey, but they breed more, by the use of ekes, and are thus prepared to do more work in future. The markets will determine whether eking or supering is the most profitable. If the

price of honey be 1s. per lb., and comb 1s. 6d. per lb., the one mode of enlargement will be equal to the other for profit. In the use of supers there is the risk (in hot seasons very great risk) of swarms coming off unexpectedly and flying away. In the eking mode there is the trouble of running the honey and jarring it up for sale.

But eking does not always prevent bees from swarming? Not always, but in ninety-nine cases out of a hundred it does. In some hot seasons, and on rare occasions, bees have been known to square the ends of their combs before their hives were quite full, and swarm. But this so seldom happens that it may be considered exceptional, and out of the usual run of events. When our hives are timely eked we have never the shadow of a fear that they will send off swarms.

It is by the use of ekes that the bee-keeper can get hives in good seasons to weigh 100 lb., 120 lb., and 140 lb. each. But why not have hives big enough to do without eking? This question has been already answered. In rainy seasons, or cold ones, swarms cannot fill such large hives; and it is of great importance to have all the hives kept for stock full or nearly full of combs.

When ekes are used, cross-sticks are put in them at the highest parts, so that the combs become securely fastened to them.

CHAPTER XXV.

NADIRS.

NADIRS are the opposites of supers. Nadirs go beneath bee-hives, and supers above them. Most bee-keepers know something of supering, but very few of them know anything of nadiring. If a hive which we wish to keep for stock becomes heavy in June or July, we place a nadir beneath it—that is to say, we lift it off its board, place a hive with cross-sticks and a large crown-hole on the board, then place the full hive on the empty one, pin the two together with strong nails, and cement the junction. The bees are soon found hanging in a large cluster, like a swarm, through the crown-hole of the nadir. New combs are speedily built from the upper hive, through the hole, down to the board; and in process of time the nadir is filled with combs and brood, almost all the honey going to the upper story. At the end of the season the top one is taken off for honey, and its bees driven into the bottom or nadir hive, which is kept for stock. Last year our earliest swarm was taken off about the 10th of May. By the end of four weeks it was full, and nearly ready for swarming. Instead of taking off a virgin swarm, we placed it on a nadir. At the end of the season we found that it weighed 70 lb. All the bees were driven below, and the top one removed. It weighed 50 lb. and the nadir 20 lb. We thus got nearly 30 lb. of honey and a stock-

hive from a swarm in May. A few pounds of refuse honey were given to the nadir, which is now (Jan. 20) a strong hive. This nadiring is an old practice of ours when we seek both honey and stock-hives from swarms of the current year. But would it not be more profitable to super them instead? Perhaps it would, if honeycomb realises a much higher price than run honey; but two things are to be considered. 1st, That nadirs give the bees more scope for breeding, and hence nadired hives gain weight faster than supered hives, all things being equal. 2dly, That nadirs are generally better for stocks than supered hives, inasmuch as supered hives are almost always too full of honey and too scant of bees for keeping. Bees much more naturally fill a nadir than a super. Where run honey commands as high a price as honeycomb, either eking or nadiring hives when full is much more profitable than supering them. Every shrewd bee-keeper will soon find out which system of enlargement puts most money into his pocket. In ninety-nine cases out of a hundred, eking and nadiring prevent swarming. The use of supers does not prevent swarming. A considerable risk is run by bee-keepers who super only; swarms are so apt to leave their hives.

Nadirs may be used sometimes as artificial swarmers. Suppose a hive is nearly, but not quite, ready for swarming: it will be quite ready in five or six days, but we shall not be able to see it for fourteen days. Well, to save ourselves from any anxiety about losing a swarm, we put a nadir below it. When we return to it, a fortnight afterwards, the nadir is one-third filled with combs. The two are cut asunder, *without smoking*, and placed on separate boards, then on separate stands, six or ten feet apart. It is *fortunate* when the queen is in the nadir hive, for, otherwise, the bees in it would be apt to

build too many drone-combs. This mode may be called an artifice or strategy for those who cannot find time to visit their hives often; and it is a substitute for artificial swarming.

We wish the reader to know that we consider nadirs inferior to ekes when weight of honey is the only object sought. They are adopted when both honey and stocks are sought from hives that become full rather late in the season. For gaining great profits in a favourable year, and for continued prosperity for a succession of years, the system of having strong hives and early swarms lifts itself up in statuesque form far above all the other systems of managing bees. Supers, nadirs, and ekes are useful, profitable, and indispensable for hives that require enlarging later in the season. The question of which is best, the interests and aims of the bee-master must determine.

CHAPTER XXVI.

ARTIFICIAL SWARMING.

It does not pay to wait and watch for hives casting, and it does not pay to lose swarms; in fact it grieves a poor man very much to know that in his absence a swarm of his has been lost. The adoption of the invaluable invention of swarming artificially saves the bee-keeper from a world of anxiety and the loss of swarms. Who was the inventor of this we cannot tell. My father adopted it, if he did not invent it, nearly seventy years ago. He swarmed his bees artificially before he knew the value of fustian smoke for stupefying them. After finishing his day's work he often swarmed three and four hives on an evening; and the only bee-dress he used was a cabbage-blade hung over his face; and this was for ever cast away when he was taught by the Irishman to use the smoke of fustian rags.

The late Dr Campbell, author of many works, and editor of many periodicals, once said, "Thank God for short-hand!" Artificial swarming, like shorthand, is a great and useful invention. The bother of bee-keeping would be too great for us if we did not swarm artificially. We can easily take off four swarms in an hour; and with the assistance of a lad to drum a bit, we could take off six swarms, place them all in proper places, and cover them up in less than an hour. The process of artificial swarm-

ing is a very simple affair—so simple that no bee-keeper can see it done without understanding it pretty well.

It is much more easily performed and sooner done than we can describe it with our pen. Given a hive ready for swarming, and a skep prepared to receive the swarm, another empty hive and a table-cloth or piece of calico are required. These are placed some yards—it does not matter how many—from the old hive to be swarmed.

A few puffs of smoke are blown into the hive, which is then carried to where the empty hive and calico are. It is turned upside down, or placed on its crown; then the empty hive is placed on and over it, the calico rolled round the junction of the two to keep all the bees in. The hive to receive and contain the swarm for good is placed on the board of the old hive with a view to prevent the bees flying about and going into other hives. The reason why the hive with cross-sticks is not first placed on the hive to receive the swarm is owing to the difficulty of seeing the queen in it. The bees hang in clusters on the sticks, hence they are first driven into an empty hive, in which the queen is easily seen, then shaken into the other prepared to receive the swarm. Now the driving or drumming commences, which is simply done by beating the bottom hive with open hands for five or ten minutes. This drumming causes the bees to run up into the empty hive, and in nineteen cases out of twenty the queen goes with the bees or swarm so drummed up. But to be quite sure that the queen is with the swarm, we take the hive (now containing the swarm) off the parent hive, turn it upside down, exposing the whole swarm to view in order to see the queen. She is easily distinguished, and when we have seen her, we take the swarm back to the old stand, and shake them all into

the hive ready for them, the calico meanwhile being spread over the old hive. The swarm is now placed three or six feet to the right, and the mother hive as far to the left of the spot or stand on which it stood before. Both are covered, and the work is done. How easy and simple this work is ! how soon over, and how natural it appears ! It is just about as easily done as shaking a natural swarm from a branch into an empty hive. And look at the advantages : the bees are not allowed to waste their time in clustering about the door of the hive before swarming, and this clustering, in some cases and seasons, continues for weeks. The artificial system prevents this waste of precious time. Again, the bee-keeper can use it at his convenience—morning, noon, or evening, and when there is the appearance of a continuation of fine weather. It is a great advantage to a swarm to get three or four fine days after being put into an empty hive. In the chapter on feeding bees, the advantage of attending to young swarms in showery weather will be pointed out. Where swarms are taken off, there is a greater certainty of getting second swarms, and this is an important affair in an apiary of large hives, for in a honey season large hives that do not send out second colonies become far too heavy for stock-hives. In mentioning the advantage of second swarms, I am aware that the great bulk of English apiarians do not agree to what we say ; but we are fully convinced that as soon as they adopt larger hives, and seek the largest quantity of honey possible from them, they will consider second swarms an advantage, and that not a small one.

Many other favourable views of the advantages of artificial swarming could be presented here, but we think that the fact of its answering as well as natural swarming, and that it can be done in a few minutes by business or working men in the cool of the day, after labour has been laid

aside, is sufficient to convince every earnest bee-keeper of the folly of waiting or watching day by day for swarms coming off naturally.

But the reader may say, "I am timid, and can't believe that I could manage to swarm my bees." A great American once said: "*I can't do it* never did anything; *I'll try* has performed wonders; but *I will do it* has performed prodigies." The reader must allow me to tell him that he can swarm his bees artificially if he wills to do it; and what now appear wonders and prodigies in the management of bees, will by-and-by be felt in his hands to be as simple as taking a draught of water.

But suppose the reader adopts this art of swarming, how is he to know when his hives are ready for swarming, and what size of swarms to take when they are ready? These questions are important. A little experience will give more instruction than our pen can. Of course when bees begin to cluster at their doors they are ready for swarming. Large hives seldom cluster before swarming, and small ones almost always do. But by using the smoke of fustian we can ascertain when hives are ready for swarming—that is to say, full enough for swarming. When smoke is blown into a hive the bees run up amongst the combs, and if the hive is lifted off the board there will be but a thin sprinkling left on it. When they can so run up amongst the combs the hive is not full —not ready to swarm. But when it is ready, the hive is full of bees, so that the smoke drives them from the door, but not up amongst the combs, which are already well packed. Well, on lifting this hive there will be a rope or ring of bees on the board about as thick as a man's wrist. The smoke has driven them from the door as far as they can get, and when the hive is lifted, the bees of this rope begin to run over the edges of the board, so that, when

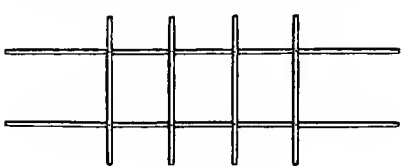
the hive is replaced, many bees are on the outside of it, most behind. Of course the number of bees on the board, or the thickness of the ropes, will be greater in some hives than others, according to their construction, size, and ripeness. This is a far better test of the readiness of a hive for swarming than the appearance of drones in it, or the heat or noise of it. A hive is often ready to swarm before drones are perfected in it; and in unfavourable weather it is often as full of bees as it can hold when there is neither much noise nor heat. The examination should be made when bees are not in the fields —that is, when they are all at home.

The other question may be answered by saying that we follow the rule of the bees themselves. When a swarm comes off naturally, bees enough are left to cover the combs barely or thinly, so that the brood of the hive may be all hatched. Now, in artificial swarming we leave the combs of the old hive as well covered as in natural swarming. If too many have been driven up with the swarm, we put a few spoonfuls back; and if too few have gone with the swarm, we drum up a few more, and unite them to the swarm. A little experience will make this matter safe and easy to the hand and judgment of the reader.

In bee-houses, and where many hives are standing close together, there is a little difficulty in placing the swarm and mother hive aright, that is, so as to prevent any of the bees of the one going into the other. When each can be placed at least four feet from the old stand, one to the right and the other to the left, there is scope for successful action in this matter. We often succeed—nay, always succeed—though there may be less room than four feet on each side; but then we have to use a little stratagem. The flight-boards and front of the hives have to be disfigured, so that the bees may not know or discover the en-

trance of the old hive. When the doors of the two are so near each other, some of the bees in the swarm will probably return to the mother hive. This we prevent by so altering the appearance of the door for a day or two that the bees do not know it, and after working one or two days they will not go back. A few pieces of broken bricks or stones or coals laid on the flight-boards up to the entrance answer admirably.

The reader will remember that we said, the farther hives are placed asunder the better; and where the artificial system of swarming is practised, the wisdom of that remark will be acknowledged. Artificial swarms must not, like natural ones, be placed 12, or 20, or 40 yards from the stands whence they were taken; for if they are not, the bees will return to their old hives. If moved one or two miles off, they will be out of the influence of their old home, and, weather permitting, will do well there. My father being on good terms with all the farmers of his parish, was permitted to put his bees on any convenient place on their farms. Well, on an evening he often swarmed three or four hives, put the swarms on a light hand-barrow, and with the assistance of another carried them 1½ mile off, placed them under a hedge, or in an old lime-kiln or quarry, or in any odd corner, where they remained unmolested till they were removed to the moors.



Bee-Barrow.

This barrow is simply made by six larch rails, very

thin and light, altogether weighing not more than 7 lb., being held together by eight screw-nails. As soon as the bees are placed, the nails are withdrawn, the rails tied together, and carried home. When only two hives are removed, a common "yoke" placed across the shoulders, the hives hanging like a couple of pails of water, is a safe mode of carriage.

In our practice we do not remove swarms to a distance, simply because we have not time to do so. The most of our hives are placed in cottage and market gardens some miles from home; and being a florist, our busiest time is in the swarming month, May. The evening is the best time to swarm artificially, but then we have most customers to speak to. So we go and swarm our bees about midday, when they are busy at work, place the stocks and swarms as far asunder as convenient, and find that they do very well. We have no anxiety or trouble with first swarms, and could swarm 100 a-month during the hour for dinner, if they were all in our own garden.

It will be seen and understood that we take care to see that the old queen goes with every first swarm. Hence we look for her, and the way and time of doing so has been already described. But it is not absolutely necessary to see the queen in every swarm, or even to look for her. Young beginners, mere 'prentice hands in bee-management, will succeed beyond their expectations by drumming rather more than half the bees of a hive ready for swarming into one prepared with sticks and guide-comb for the swarm, and placing them right and left off the old stand. And when no time is spent in looking for the queen, anybody can take off a swarm, artificially, in ten minutes at most, and often in five minutes. It should be remembered that five minutes is quite long enough to drum in hot weather; when weather is cooler

the bees do not run so fast. If the queen does not go with the swarm, all the bees will return within the space of an hour to the old hive. Farther than loss of time, no harm has been done. A second effort will have to be made.

"When we fall we aye rise up again,
And so will we yet."

It is but rare indeed that the queen does not go with the bees on being first drummed up.

But in artificial swarming, the old or mother hives are deprived of their queens, and, generally speaking, have no eggs set in royal cells. They are therefore without the appearance or prospect of successors to their thrones. What happens? The bees, on discovering their loss, are thrown into a little consternation, which is of short duration. Some few bees will now and then come out of their hives, run about the front of them, and go in and *tell the rest* she is not outside. When fully convinced that she is gone *for good*, they commence to prepare royal cells for the reception of eggs—common worker-eggs—from which they raise queens. Often they let the eggs selected for queens remain where they find them, but so alter the size and shape of the cells containing them, that they become at once royal cells.

No fears need be entertained as to the ability of the bees making queens for themselves. They never fail to raise queens, if the hives have left in them sufficient bees to cover their combs thinly. Well, these eggs placed in royal cells, or otherwise royal cells built around them, become perfect princesses in fourteen days, when the piping and barking begin, which we explained in a former chapter. After three nights' piping, second swarms may be expected, if the weather be at all favourable for swarming. And second swarms are *less particular* than first

ones about having fine weather on the occasion of their leaving home as colonists. But cannot second swarms be taken off as well as first swarms, artificially? Yes; but it is necessary to be a little more cautious while doing it; for such young queens or princesses are apt to take wing during the operation. Old queens never take wing, however much they may be handled and tossed about in swarming and uniting of swarms. Not so with these young unimpregnated ones. Hence there is a little manœuvring required in swarming second swarms by art. As soon as the queens are heard calling and answering each other (piping), we turn up the hive and cut two of the royal cells out, those having queens in them, and wrap each up in the corner of our handkerchief, separate, and so that the queens cannot come out of their cells. We have got over the difficulty; and in less than five minutes a swarm is drummed up into a hive prepared for it: the swarm is set on one side of the old stand, and the mother hive on the other side. In the handkerchief there is a queen for each hive. We generally take the lids off the cells, and see the beautiful young creatures run in at the doors. All this may be done in ten minutes. It requires no master-stroke to do it; any one that puts aside the mistrust of his own powers will manage this affair easily.

If there are more than two queens comeatable, we cut them all out; and this is often the case, for there are sometimes four or five to spare. But presently we shall come to notice the use and value of these spare queens. Let us finish the artificial mode of swarming first. Hives that yielded first swarms have sometimes small second swarms taken from them, and two of these united thus making one good swarm, and leaving the old ones strong.

in bees, hardly feeling the loss of those taken from them. Let me by figures show how this is done.

1	2	3	4	5	6	7
○	○	○	○	○	○	○
1st Swarm.	*Stock.*	*Stock.*	*2d Swarm.*	*Stock.*	*Stock.*	*1st Swarm.*

At the commencement of the season let us suppose we have two stock-hives—standing at 2 and 6. When the swarms are taken from them they are moved to 3 and 5, and the swarms to 1 and 7. 2 and 6 are blotted out altogether, and 4 remains unoccupied. And suppose we want one swarm more from the two old stocks. Part of a swarm is taken from each and set at 4, removing the old ones back to their original stands, 2 and 6, leaving 3 and 5 empty. If it be deemed advisable to take a second swarm from each, and keep them separate, their positions will have to be arranged a little differently.

In the case of second swarms, we can tell pretty certainly the day on which they will swarm naturally, if we listen for the queens commencing to call. They almost invariably call or pipe for three nights, and swarm on the day following: there are some hives which do not send off second swarms till their queens have called for four or five nights, and even longer, but these are exceptional, and no one can tell why such hives are so slow to swarm.

SURPLUS QUEENS.

Now we come to notice the uses of these surplus queens. By using them aright, the bee-keeper does exercise some master-strokes of policy and good management. They will be welcomed into hives without queens, and into hives

with princesses unmatured, if presented to them. Suppose we have one or two hives ready to swarm for the first time when these queens are available. We hasten to take swarms from them, and as soon as the bees in the old hives have discovered the loss of their own queens, we give them young ones instead. This is a grand idea, full of stimulus and suggestion to earnest bee-keepers partially enlightened. The hives that thus get queens as soon as their own are taken from them are *lifted* fourteen or sixteen days in advance of those which do not receive queens. For it would take them fourteen days, at least, to rear queens, even if the eggs were set the hour on which they lost their old ones, and the queens from those eggs were allowed to leave their cells on coming to perfection. These transplanted queens would lay about 28,000 eggs in fourteen days—that is to say, before the queens reared in the hives begin to lay at all. Of course, the introduction of these surplus queens to hives that have just swarmed, either naturally or artificially, prevents all preparation for throwing second swarms. The old hives are never without brood, for the young queens begin to lay before all the brood is hatched. Such hives soon become very strong, and capable of doing a great deal of work in various ways. In honey seasons they will fill two or three 10-lb. supers, or one large one; and if not supered but eked, they will rise in weight to near 100 lb.

In the case of hives swarming late—say in June—it is of vast importance to give them queens; for, if left to rear queens for themselves, the season is nearly over before the eggs of such queens come to perfection. Let us see how long it is before young bees are matured from such queens. A swarm is obtained on the 15th of June. The eggs will be matured into queens in fourteen days—*i. e.*, about the last day of the month. If there be no days

wasted in piping and preparing to send off a second colony, the young queen will take the drone in three days, and commence laying in about ten days after—say about the 12th of July. Well, the brood is three weeks in the combs, so that the month of July is nearly gone before young bees are hatched. First swarms have pregnant queens, and generally do well, though they do not leave till the middle of June; but it is otherwise with the old hives and second swarms. Here we see the advantage of having all hives ready for swarming in May, or very early in June; and here also we see the advantage of importing queens from early swarmers into later swarmers. It were easy for us to fill ten pages of this book with matter illustrating the value and importance of helping hives by importing queens into them, while they are without them, or raising young ones. With young queens at command, we can take three moderate swarms from a large hive in one season, and never deprive it of its own queen. The young ones are given to the swarms, while the combs of the mother hive are always kept full of brood by the eggs of the queen remaining, when this is done.

Small bee-keepers oblige one another by transplanting surplus queens from one apiary to another when wanted. One thus enriches his neighbour without injuring himself.

Since this chapter on artificial swarming was written—indeed after the manuscript was completed—a letter has been received from a gentleman in Wales, asking the author to state very simply and fully how queens can be found or seen amongst the bees that have been driven up into empty hives.

After a swarm has been driven into an empty hive, it is turned on its crown, not gently, for we wish all the bees to fall from the sides of the hive on the crown, and

when they are running back, we try to get a sight of her majesty. She is very conspicuous and easily known, but the eye of the bee-keeper does not see all parts of the swarm at once. And as the queen is very modest, she often hides herself amongst the bees before she is noticed. In about two minutes all the bees leave the crown of the hive and settle on its sides. When she has escaped our notice the first time, we give the hive a great "thump," and thus bring all the bees on the crown of the hive again, when they rapidly leave it for the sides, giving another opportunity of seeing the queen. But instead of shaking them down a second time, we sometimes *spoonful* them down on the crown of the hive, allowing each spoonful to run off before we put another down; and by beginning at one side of the swarm, and going all round it in this process of spooning them down, we cannot miss the queen, if she is with the swarm, and in nineteen cases out of twenty she is. It is very rare indeed that bees sting, or ever think about it, when dealt with in this manner. And after a man once does it, he has no more fear of using a spoon amongst his bees than he has in using it for taking mashed potatoes from one plate to another.

CHAPTER XXVII.

NATURAL SWARMING.

This has been described in the first part of this book; but as there are so many things in natural swarming that should be well understood, we trust we will be excused if we venture to examine briefly a few of them.

The time or season of swarming depends on both the locality and the management of the hives. Some places are warmer and earlier than others. Some places have more spring flowers than others. In the southern parts of our island, swarming, in ordinary seasons, should commence in the beginning of May. The earliest natural swarm we have ever known was at Rosebank—a small village on the Clyde, in the centre of Lanarkshire. It came off on the 28th of April. We have heard of swarms coming off in April in Dorset and Devonshire. These are early parts. In Lancashire our hives begin to swarm about the 10th of May; but much depends on autumn treatment. If hives kept for stock are crammed full of bees, then they will be ready to swarm four weeks sooner than those that are left to their own resources. But we have already touched on this point, and will return to it again.

When hives are ready to swarm and mean to do so, eggs are set in royal cells generally about four days before the swarms issue. The combs are well filled with

brood from the egg up, in all stages. The hives are chokefull of bees. The noise and internal heat of such hives are very great. They may or may not cluster outside. Generally speaking, as has already been said, small hives do cluster and large ones do not. Whether this clustering of small hives is owing to the fact that they are hardly able to send off respectable colonies without first accumulating outside, or from other causes, I am unable to say; and whether the large hives swarming before they are quite so full as small ones is owing to the inability of the bees to ventilate by their own natural powers such large hives, I am unable to say.

Hives, whether large or small, that have but little honey in them, are much better filled with bees than hives containing a good deal of honey. Bees do not sit closely on honeycomb, even on the eve of swarming. Hungry hives, *i.e.*, those with little honey in them, yield much the largest swarms, and afterwards remain stronger in bees. First swarms vary in weight from 4 to 8 lb.; second swarms from $1\frac{1}{2}$ lb. to 5 lb. The second swarms of small hives are hardly worth the hives into which they are often put.

We have said that the eggs are generally four days in the royal cells before first swarms issue. But sometimes the weather prevents the bees from swarming till the young queens are nearly matured. The time is therefore uncertain. Sometimes there is a miscarriage. The swarm goes without the queen, and soon returns. Next day, probably, a successful attempt will be made, both swarm and queen going together. Sometimes there are several miscarriages. The swarm always returns. How is this? The queen cannot fly. In attempting to follow or go with the swarm she falls over the flight-board, and may be found crawling on the ground. The noise of the bees

on their return attracts her into the hive. This may happen again and again; hence these miscarriages. Such queens are old, and will die soon. If a young virgin queen could be obtained anywhere, it were wise to unite her to the swarm rather than carry the old one to it. Either old or young queen put into a hive with the swarm will make it stay there. And if the old queen be found below the flight-board or in front of it, and we have not a young one to take her place, the better way is to put her into the hive prepared for the swarm, and place it on the old stand—removing the old hive for half an hour, or till the bees have all returned. After the bees have gone into the empty hive and found their queen, it can be placed in any part of the garden, and the old one put back to its original place.

While a swarm is in the act of leaving the hive, there sometimes comes a sudden change of the atmosphere. The sun is clouded, the air chilled, rain may fall. The bees already on wing cannot fly—they are all full of honey, and come to the ground in thousands. (Bees are unable to carry such heavy loads in shady cold weather as they carry in the sunshine.) If a heavy shower follow, thousands upon thousands never rise. The attempt to swarm at an unfavourable moment is often disastrous. The skill of the bee-keeper can do little in such a case. If a small cluster reach the place chosen by the bees, they should be brought back and thrown on the front of the old hive. If the sun shine out warmly in the afternoon, or even next day, many of the bees which fell will rise again and go back.

Swarms generally alight on a branch of a tree or bush, or hedge, if either of these grow near the hives whence they issue. Where there are no trees or hedges, they will choose to settle on a stone or post in a fence, or a

clod, or big weed in a garden. It is wise to have some bushes near an apiary managed on the swarming system; for swarms can be easily hived from branches that bend. I need not take up time or space in describing how swarms should be hived, for everyhody with a little courage can do this.

Hiving is generally done by holding the hive prepared for the swarm underneath it and then giving the branch on which it hangs a sudden shake or jerk, when all the bees lose their hold of the branch and fall into the hive. The hive is set on the ground with its crown downwards, and mouth and swarm exposed. The board is instantly placed on and over the whole, just giving the bees time to gather their feet and get hold of the sides of the hive (about half a minute) before it is inverted into its proepr position. Let it stand for a few minutes to gather in all the bees that have not been hived—the noise inside will speedily attract them—and then let the hive be placed where it is to remain. When a swarm goes into the centre of a thick hedge, or settles on a stone or wood fence, the hive is placed over it, so that the bees can easily go into it. When it settles on the trunk of a tree the hive is tied on above it; and when it settles on a top branch far from the ground, the branch is gently cut and let down.

Nothing should be put in hives intended for swarms but cross-sticks and guide-combs. Ignorant people often wet their insides with sugared ale, or sugar-and-water, a most foolish practice.

Another foolish practice, and a widespread one, is to make a great effort to induce swarms to settle by drumming on kettles and frying-pans, thus producing artificial thunder, with a view to frighten the bees from all idea of flying away. Sand and soil are thrown up amongst the

bees to make them believe it rains! Such artificial thunder and rain have no more influence over a swarm of bees or its destination than the sigh of a butterfly in love.

Fortunately swarms almost always settle near home for a short time before they seek a more abiding habitation elsewhere; but when they have decided to go to a distance, and have commenced their march, all the old women and frying-pans in England will not stop them. We have known one or two fugitive swarms shot at. The poor fellow who shot said, "If I can hit and bring down the queen the bees will return." He was right enough in his ideas, but unfortunately he did not hit the queen, and lost his swarm.

These fugitive swarms rise higher than houses and trees, and travel at the rate of about eight miles an hour; so it is hard work to follow them: still a man swift of foot can follow them, if no impediments come in his way.

If a swarm is not speedily hived it may be lost, and sometimes it will hang for a day before it departs. Old combs in the hollow of a tree or roof of a house, are very inviting. All hives that have lost their bees in the winter should be placed where swarms cannot find them. Some dishonest persons expose their dead hives with combs in them, for the purpose of catching swarms not their own. Such people are thoroughly dishonest, and would steal horses and cattle if these could not be identified.

When a swarm alights on two separate places or bushes, both lots should be hived together.

In large apiaries, two swarms, and sometimes three, issue at the same moment, and generally unite. The queens go with the multitude, and follow the noise. It is an awkward affair when two swarms unite, for to separ-

ate them is rather difficult. Some of the extensive bee-keepers of America use "swarm-catchers" to prevent such unions. These swarm-catchers are about 12 inches square at the end, and 4 or 5 feet long. Four posts about one inch square, fastened as a frame and covered with muslin or other thin cloth, may be termed "the American swarm-catcher," and is simply a square sack of thin materials. Well, when one swarm is half or wholly on the wing, and another commences to issue, the sack or swarm-catcher is placed around the door of the hive, and the swarm rushes into it, and may be hived as convenience may dictate.

But two swarms united may be separated—that is to say, the two queens may be caught and put into separate hives, and the bees divided between them. There are various ways of doing this, all of which will answer if done with a skilful hand. The man who can swarm bees artificially has experience and ingenuity enough to divide and sub-divide swarms as much as he likes. The man who has not courage to do this will let both swarms remain together. If separation be attempted, it should be done as soon after swarming as possible, otherwise one of the queens will be destroyed.

When two swarms belonging to different people unite and cannot be separated, the one who retains the swarm should allow the other about half value—say 10s. for a 20s. swarm, for it is of less value in its united state than when separate and single.

In natural swarming, the old queen goes with the first swarm, and leaves behind her in the old hive eggs or grubs in royal cells. What happens? As soon as the queens come to perfection the piping commences, and lasts for three days and nights. If the bees determine not to send off a second swarm, the piping is stopped, and all the surplus queens killed and cast out.

If the piping continues, a swarm may be expected; and if a second swarm issues, and the piping continues still, a third swarm may be expected on the day following. A third and a fourth swarm have been known to come off on the same day. It does not answer for queens to pipe three days before third and fourth swarms; the time for their impregnation has arrived, and they cannot wait with safety. When third swarms come, they are close on the heels of second ones.

Is it profitable to take third swarms? Not often. In very favourable seasons they may fill their hives, and weigh 40 lb. or 50 lb. each; but in ordinary seasons two swarms are sufficient to take from one hive.

It is often desirable not to take second swarms from late swarmers. But if they come when we do not want them, what is to be done? Hive them, and let them remain for a few hours in their hives, and then throw them on the flight-boards of the hives that sent them off. In nineteen cases out of twenty they do not issue a second time. But is it not wise to kill the queens of the swarms before returning them? It may be, but we never do it, when uniting swarms at the swarming season. We have known one instance only in which the conflict of two queens ended in the death of both. The bees often, no doubt, interfere to prevent a conflict between two queens thus brought together. Queens may often be found in the centre of small hard clusters of bees, which some apiarians term "regicidal knots;" but it is a question whether these knots are meant to destroy or protect the lives of the queens.

If the piping be heard after the swarm has been returned to the old hive, it will probably issue again, and should again be thrown back; but this, as we have said, seldom happens; for after the second swarm has departed,

all the queens but one are generally destroyed, and when the swarm is thrown back one of the two queens is destroyed, and no more swarming takes place.

There is in the history of swarming a critical time for old hives and second swarms. A day or two after second swarms have left their mother hives, queens go out to meet drones—the queens of both old and second-swarm hives. The bees become very uneasy if their queens stay long away. Sometimes they never return. They are lost on their marriage-tours. When the bees of a hive find they have lost their queen, they make manifest their loss by their wild commotion and bewilderment. No one can witness this commotion without seeing that something is wrong. The bees every now and then are in a state of wild excitement, rushing hither and thither in search of the lost queen. They have no eggs, and therefore are unable of themselves to make good their loss. What should be done with hives thus bereft of their queens? If surplus queens can be obtained, they should be introduced at once to these queenless hives. If ripe queens cannot be obtained, probably royal cells containing infantile queens may be had. One of these cut out of their hives, and placed between two combs of the queenless hive, answers well, for the bees soon cement it to their own combs, and bestow proper care on their now infant and future queen. In the case of the swarm, it will be rather dangerous to turn the hive upside down, with a view to place a royal cell between the little bits of combs which may have been formed, these being apt to fall when the hive is jarred, or turned, or held unlevel. Even the smoke should be gently blown into a swarm recently hived. But if one person lifts the hive off the board, say three feet perpendicularly, and another person

puts in the queen-cell, the work may be safely performed. And if no combs have been formed at all before the queen has been lost, how can a royal cell be given to the swarm? In such a case, we resort to a pin or skewer of wood, sharpened at both ends. The royal cell, with a bit of comb attached, is stuck on the one end of this skewer, the other is stuck in the side of the hive, leaving the comb with the infant queen in the centre of the swarm. The bees know the value of the boon thus bestowed; a great calm and hum of joy take the place of the wild roar of excitement. If neither a matured queen nor an infant one can be obtained, the case is not at all hopeless. Remember that bees can make queens from common eggs; so that we have only to cut a small bit of comb containing eggs from another hive, and place this bit of comb between the combs of the queenless one, in order to avert the threatened loss of the swarm or mother hive. The moment the bees of a queenless, eggless hive receive the gift of one or a few eggs from another hive through the hands of the owner, they begin to fashion royal cells and royal tenants in them. Two notable instances of bees without queens finding eggs for themselves have we known. They had been without queens, and of course eggs too, for fourteen days or thereabouts, when an egg was seen in a royal cell in each hive. This was a most unusual and extraordinary occurrence! Where did the eggs come from? They must have been stolen from other hives, not by the hand of man, but by two bees, remarkable alike for wisdom and courage. Brave bees! you injured no other community, but you saved your own from ruin and extinction!

If a second swarm, or the old hive, lose its queen on its marriage-tour, and the other does not, they could be

united, as one queen would answer for both. And in other ways queenless swarms can be used up. They can be united to weak hives and small swarms, and removed to a distance for a while. But if the owner wishes to keep them separate, he has only to give them an egg or two, so that they may rear a queen of their own.

CHAPTER XXVIII.

TURNOUTS.

This is a name we give to swarms evicted or ejected from parent hives three weeks after they sent off their first swarms. Second swarms may have gone from them as well as first ones; but, on the twenty-first day after the first swarm leaves a hive, the combs are free from brood, save a few drone-cells, drones being twenty-four days in being hatched, and workers twenty-one days. The eggs laid by the queen on the morning of the day she left the hive with the first swarm, come to perfection on the twenty-first day after. The young queen that has taken her place has not yet begun to lay, and therefore there is no brood in the hive. Very well. Large hives gather a great deal of honey before they swarm. If the weather be fine while fruit-trees are in blossom, they generally lay by from 3 lb. to 5 lb. a-day per hive. In fine seasons, large hives, properly managed, contain from 20 lb. to 30 lb. of honey before the month of May closes. New honey will not be in the market for a month or two after May, if we do not evict or turn out the bees from these heavy hives. But we do turn them out; and for sixty years at least my father and his son have practised this mode of getting honey in great quantity so early in the season. Such honey is superexcellent, and commands not only a high price but a ready sale. What do you consider a good

price for such honey? Fifteenpence per pound, or 6s. 6d. for the Scotch pint of 5 lb. If there be only 20 lb. in a hive, we drum the bees out of it into one empty, save cross-sticks and guide-comb. In this way we get 25s. worth of honey, and another swarm, which we term "a turnout," from the stock-hive, which has before yielded one or two swarms. Thus we get two or three good swarms and 20 lb. of honey early in June from every stock-hive. These turnouts are generally a shade better than the second swarms from the same hives; and when no second swarms have been obtained or taken from the hives, the turnouts are very large swarms indeed, and require large hives. By practising this mode of taking honey from stock-hives three weeks after first swarming, our hives have combs beautifully young and fresh, free from foul brood, and never overburdened with farina or bee-bread. Then there is the encouragement of profits already in the pocket, and two months of summer yet to come.

A hive should be about 42 or 45 lb. weight to yield 20 lb. of honey. Sometimes we pass sentence against hives of less weight, drum the bees out on the twenty-first day after swarming, and take honey from them; and sometimes, instead of taking their honey, after the bees have been turned out of them, we place them in a dry room till autumn; and if we then find it will be advantageous to keep them for stock, and take the honey from heavier hives, they are refilled with bees taken from the honey-hives, and placed in the garden.

The process of turning bees out is simply that of driving them into empty hives. In the case of artificial swarming we drum but a few minutes, but when we wish to drive all the bees out, we drum for fifteen minutes or more. When there is brood in a hive the bees are loath

to leave it; but as the hive that swarmed three weeks before has no brood in it, the bees are easily driven out.

We shall be sorry if we find that we have failed to give the most ignorant bee-keeper that reads this work a correct and complete idea of this process and principle of eviction; for we reckon that if he well understands what we aim at and realise, and how we compass the whole, he will stand on a higher platform than many pretentious bee-keepers.

The turnouts of small hives may be united to second swarms if they happen to stand side by side. It is understood that if the spring months have been unfavourable for honey-gathering, the hives will be too light for yielding much honey. In such season there will be no turnouts.

But, looking closely into this turning-out system, the reader may say, "It is not a wise and economical one; for, by putting the bees into an empty hive, you compel them to make new combs, which cost them a great deal of honey. Leave them in their own hive, and thus save the consumption of honey necessary in the building of fresh combs." This remark is both logical and philosophical, and, moreover, full of common-sense. No sensible man will attempt to resist its force. But it is found wanting when put in the balance against "the almighty dollar" of a good honey season.

CHAPTER XXIX.

FEEDING.

In bee-keeping, as in other things, it is not all honey and sunshine. Stings and venom-bags are placed side by side with honey-bags in the bodies of these industrious creatures. Cold, rainy seasons come sometimes; and when they do come, bees have to be fed pretty constantly. One year well remembered by some apiarians, the best hives, though well attended to, never rose in weight beyond 22 lb. each. They were near starvation-point the whole of the summer. In such seasons the management of bees is attended with anxiety, disappointment, and loss. Part of the profits of other years have to be spent on sugar to keep them alive. On two noticeable years bees had to be fed from April to August, when the weather changed, and became so favourable for honey-gathering, that strong hives rose rapidly in weight to 70, 80, and 100 lb each. It is rather an unfortunate circumstance for a working man to commence bee-keeping in a wet season. His bees must be fed again and again; and his wife does not like to see so great a waste of sugar, and may grumble sorely about it. To put an end to such loss and dissatisfaction, he sells his bees at a sacrifice. Such failures we have seen with sorrow. We should be glad if any poor words of ours contribute in the smallest degree to encourage all

beginners to go forward, even if one bad season succeeds another. Success is certain to the persevering. During the last twenty years we have had far more favourable years for honey-gathering than unfavourable ones. The last few years have been unusually favourable for bee-keeping. In our native village in Lanarkshire, the profits of bee-keeping in 1864 were about £4 per hive; in 1865, about £3; in 1866, about £2; in 1867, nothing; in 1868, between £3 and £4; and in 1869, about £3. But years unfavourable for honey-collecting may be expected; and when they come our bees will require attention and feeding. We do not care much how bees are fed, so that they get enough.

As large hives, well populated, gather more honey in favourable weather than small ones, it should be borne in mind that they consume more in rainy weather. Hives that gain 5 lb. per day in fine weather, lose 1 lb. in weight during the night. Of course, when bees are not at work, the wear and tear and heat of a hive are not so great; but I have known a hive become 7 lb. lighter, and eat 1 lb. of sugar as well, during one unfavourable week. In a large hive there are probably upwards of 50,000 bees, and about the same number in embryo in their cells. Both bees and brood need food, and a great deal of it. He is the best bee-master who feeds his stock liberally and judiciously in rainy summers, for he will receive in return for all his attention and liberality, good measure, pressed down and running over. If bees be well fed, they remain strong and healthy—the hum of prosperity and contentment is kept up—breeding goes on—thousands are added to the community; and if fine weather come, they will gather twice or thrice as much honey as those that have been barely kept alive. If hives are kept on

the point of starvation, the bees instinctively cast out their young, and *wisely* refuse to set eggs. Their combs become empty of brood; their numbers decrease; their bankruptcy blights them for a month, if not for a whole season. We speak now of stock-hives in the months of April, May, and June.

Look now at swarms lately hived. Every natural swarm can live three days on the food it takes from the mother hive. The bees of artificial swarms, being hurried out of their mother hives, have not all filled their bags so well as those of natural swarms. If rainy weather overtake these young swarms, and continue some days, they will starve if not fed. Thousands of swarms are ruined for want of feeding after being put into empty hives. If they do not die right out, they never recover from the blight and blast of hunger then undergone.

We have known swarms starved out of their hives. Having made a few pieces of comb, and being without food, no eggs were set in them, and the bees, through sheer want, cast themselves on the wide world. These are called "hunger swarms," and their name has a painful significance.

But if swarms are well and liberally fed in rainy weather, after being hived, they rapidly build combs, and these combs are as rapidly filled with eggs from pregnant queens. A few pounds of sugar given to a swarm will enable it to build combs to its own circumference and size; and these combs, as we have seen, will soon be filled with brood, which brood, in three weeks, will come to perfection, and thus greatly add to the strength of the community. During the cotton panic, and at other times when no work was going on, some of the wealthy mill-owners of Lancashire kept their machinery in order, and

even enlarged their premises; so that when the dark day had passed away, and the sun of a brighter sky fell upon them, they found themselves in possession of greater powers for active and successful work. So the skilful bee-keeper is not inattentive to the machinery and mill-hands of *his* factories when they are not working "full time." Idleness in a bee-hive is the mother of mischief. When weather forbids bees leaving their hives, it is a stroke of good policy to give them something to do indoors. A few pounds of syrup, wisely administered, keeps up the hum of health and prosperity, promotes breeding, and prevents collapse and disaster. Often when feeding is not absolutely necessary, when there is plenty of honey in a hive, a little sugar given to it in dull weather, is of great service in keeping up its temperature, and in promoting the laying and hatching of eggs.

Loaf or refined sugar boiled in pure water, at the rate of one pound of sugar to one English pint of water, is excellent food for bees. No artificial food is so good for them as this. Indeed this food is better for them than heather-honey: the mortality of bees fed on heather-honey is greater in winter than when fed on pure sugar-and-water, mixed and boiled as described above. Flower-honey, as it is termed in Scotland, or clover-honey, is the best and healthiest food for bees; and, strange as it may appear, 10 lb. or 11 lb. of this honey lasts or feeds a hive as long as 15 lb. of honey gathered on the moors. Brown sugar is too relaxing, and should never be given to bees as winter food. On the score of cheapness it is sometimes used in summer, and with safety. White soft sugar, now sold at 4½d. per lb., is nearly as good as loaf-sugar for feeding bees.

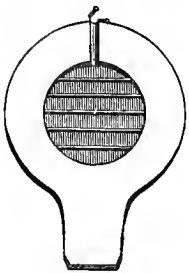
Some old-fashioned gentlemen, doubtless fond of a glass

of good ale themselves, like to give their bees ale-and-sugar instead of water-and-sugar; and some are so kind as to give them wine mixed with sugar. Pure water mixed with the sugar is much better for bees than either ale or wine. The elephant grows strong on water, the horse does its work on water, and bees want nothing better.

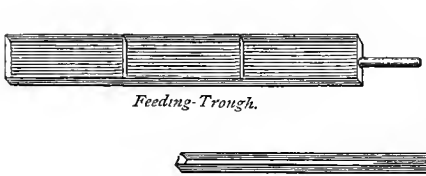
In mixing sugar and water for bees, it is desirable to present it to them sweet enough, and yet not too thick or sticky. We have mentioned one pint of water to one pound weight of sugar, that is nearly weight for weight. We wish to make ourselves well understood here, for the English and Scotch pints are very different. The pint measure of England holds four gills, the Scotch one holds sixteen gills. The uneducated classes of Yorkshire and Lancashire call half a pint "a gill." It is the English or imperial pint of water which we use with one pound of sugar. One pound of sugar and one pint of water slightly boiled, make about two pounds of excellent syrup for bees. It is about the same thickness or substance as honey when first gathered from flowers.

There are many ways of feeding bees, not one of which will we here attempt to vote down or lift our hand against. In this, as in poking the fire, most people think their own way the best. Many amateur bee-keepers feed from the tops of their hives. It is a very good plan. A kind of tin trough or cylinder, with a wooden float full of holes, is used for this purpose. The lid on the top of the hive is removed, and this cylinder filled with sugar is placed there. The bees speedily find their way to the syrup, and carry it *down* into their hive. This system prevents *strange* bees from getting the syrup without first going through the hive for it.

The following are the only instruments we have ever used in feeding, all of which are cheap, simple, and excellent.



Feeding-Board.



Feeding-Trough.

Feeding-Cistern.

The trough of our feeding-board is 11 inches wide, $1\frac{1}{2}$ inch deep, and holds 3 quarts or 6 lb. of syrup. We have known a hive—not a very large one—take 6 lb. of syrup in three hours. It is a very useful instrument, and can be refilled without touching the hive or troubling the bees. For feeding young swarms, or giving large quantities of syrup to a hive, it is far superior to anything of the kind we have ever seen. In the plate of this feeding-board it will be observed that there are cross pieces of wood in the trough for the convenience of the bees getting at the liquid. We think this is an improvement on ours, which is used without them; but then we have to use chips of wood to keep the bees from drowning. We

have never known a bee lose its life in the trough of a feeding-board.

The feeding-cistern holds about 1½ quart of syrup, and is handy. When it is used, the board of the hive must be placed very level, so that the liquid runs to the far end of the trough attached. The trough is about three-eighths of an inch deep and 12 inches long. The opening between the trough and cistern must be *less in height* than the edges of the trough, in order to prevent the syrup from running over, and the bees from going into the cistern. As the bees empty the trough, the cistern fills it. It is generally used at nights—*i.e.*, when bees are not flying about.

The feeding-trough is an exceedingly handy thing. It is used for giving syrup in small quantities to bees. It holds about a gill, but one could be made to hold more or less. A single troughful of sugar-and-water, costing about one halfpenny, given to a hive daily in dull weather, has a wonderful influence for good, even if the hive is not hungry. For the feeding of bees in spring this little trough is unsurpassed for excellence.

In hives that are not full of combs, a common soup-plate, or a flower-pot saucer, answers well for feeding bees. Some chips of wood or short straws are placed in these saucers. After being filled with the bee-food, they are placed on the boards inside the hives. In times of comb-building, the hives should be lifted off their boards with the greatest care, and without turning them in any way, otherwise their combs might be jarred down. We frequently use flower-pot saucers for feeding swarms. Lifting the hive from the board, and gently placing it on the ground for a moment or two, we put the saucer on the board, fill it with the liquid, and lift the hive again on to the board.

In feeding bees, we have all our life long tried to do the work simply and rapidly. Necessity is the mother of invention. When we have one or two dozen of old hives needing food, we do not call to our aid feeding-troughs of any kind. The old stage-coach and even the parliamentary train are rather too slow; we like to go by "express." We simply pour the sugar-and-water amongst the combs and bees, and can easily give 20 lb. of sugar to fifteen hives in half an hour. In doing this, we dose a hive well with the smoke from corduroy, turn it up, hold it, say, towards the east at an angle of 45 degrees or thereabouts, the combs running from north to south. From a pitcher or jug with a spout the syrup is gently poured first along one comb and then another, till all are gone over; then turn the hive towards the west, with combs slanting as before, and pour the liquid on the reverse side of the combs in the same manner. Owing to the slanting position of the combs, the syrup runs into the open cells before it reaches the crown of the hive. Thus one hive after another is fed; and, if necessary or convenient to give more, each hive can receive three such doses every day. The liquid thus poured amongst the bees does them no harm, as they lick it off one another quite clean in a few minutes.

This wholesale mode of feeding is perhaps the best, when we in autumn find it necessary to give some of the hives a considerable quantity. By giving it rapidly, 3 or 4 lb. a-day, the bees store most of it up, and then settle down into the quiet of winter life. If the feeding continues for some days or weeks, the bees are kept in a state of excitement, and may consume as much as they store up. They may be induced to commence breeding at an unfavourable season by feeding long continued. In the spring and summer months, when the weather is unfavour-

able, constant feeding is the best, because it keeps the hives full of glee; but in autumn, the more speedily it is done the better.

Sometimes hives have not been fed enough in autumn; and the bees in them may be found in the dead of winter starved nearly to death, so cold and hungry that they will not leave their combs for food. What should be done to save them? Take them indoors, into some house, and pour *amongst them* a little warm syrup. They will revive in a few minutes, and sing a song of gratitude. Of course the door of the hive should be closed while they are in the house, unless the place be in complete darkness.

The practice of exposing refuse honey, or hives and combs wet with honey, to all the bees in a garden or neighbourhood, cannot be too strongly condemned. Honey thus given to bees is like blood to a tiger: they will have more, and make earnest attempts to rob other hives. And there is great danger of making bees of different hives *too familiar* with one another in a "mixed congregation" thus brought together. Bees should be fed at home, and never tempted to come in contact with those of another family.

CHAPTER XXX.

IS SUGAR SYRUP CONVERTED INTO HONEY BY BEES?

This question is put in order that we may animadvert on a fraudulent practice of some bee-keepers, confined chiefly, as we believe, to one district or county of Scotland. We have already lifted our voice against the practice in a letter which was published in a very respectable periodical of the day. The bee-keepers referred to will not, we hope, fancy that we are their enemy because we speak plainly. Though we wish "the trick" to be practised no more, we have no wish to hurt the feelings of those who have been doing it quietly for years. Sugar *never* becomes honey, though swallowed and disgorged twice by bees before they store it away or lay it up in their combs. "Sugarcomb" is not honeycomb. To sell the one for the other knowingly is a trick and a deception. If people will sell syrup for honey, or syrupcomb for honeycomb, what are we to think of them? Are they at all acquainted with the golden rule of treating others as they wish others to treat them? Do they act on this principle when they palm off a trashy article for a real one? Is he an honest man, and fit to be trusted in society, who would wittingly give a bad shilling for a good one? And are those who sell spurious honeycomb, manufactured from sugar by bees, any better? If they are honest people, they will openly tell the buyers that the comb they offer for sale is

not honeycomb, but a kind that is artificially manufactured. Honest folk are not guilty of trickery and fraud.

I have reason to believe that this trick is doing a great deal of harm in the honey-market. If not speedily stopped it will soon be rather difficult to sell clear honey in one large town in Scotland. The heather-honey there is now quite as saleable as flower-honey, because that cannot be manufactured. But if our friends will at once abandon the evil practice, the confidence of the public will soon be gained —a ready sale and high prices will return. The Scotch palate, nationally considered, is fond of sweets; and genuine honey will ever be a saleable article among Scotch people, if the imposition of the syrup-mongers were to come to an end. It is in the interests of honest bee-keepers that we venture to lift our voice against the cunning but dishonest practice of sending to the market comb made from, and filled with, sugar-and-water.

Does it pay; is the trick a profitable one? This question has been put elsewhere. We answer by asking, Is it profitable to cheat, and lie, and be dishonest? Is wrong-doing the highroad to wealth? No; honesty everywhere and in everything is the best policy. We shall not stoop to discuss the question of profit in the manufacture of sugarcomb, believing that no reader of this work will ever countenance the practice.

CHAPTER XXXI.

THE DISEASES OF BEES.

Amongst the few distempers of bees, dysentery may be named. It is of very rare occurrence; but doubtless it is caused by unwholesome food, or a cold damp dwelling-house in winter. Damp hives are very destructive of the lives of bees in weak hives during the winter months. To-day (January 17th) some of our hives were examined. All were found quite dry save a few that were eked with riddle-rims. Even the hives of these were perfectly dry; but the insides of the wooden ekes were as wet as water could make them. How strange it is that some men will recommend wooden domiciles for bees!

For dysentery, loaf-sugar and water boiled is a safe and certain cure.

Foul-brood is the great and incurable malady of bee-hives. From some cause or other, and in some seasons more than others, larvæ, or half-hatched bees (or brood), perish in their cells, and become a putrid pestilential mass in a hive. Prosperity departs from a hive whenever this happens, and sometimes the stench of it has driven the bees wholly out of the hive, and made them build fresh combs underneath their boards; and sometimes they have gone off as swarms, abandoning their hives in utter despair and detestation. An experienced bee-keeper can smell this disease outside the hive, long

before it is so fully developed as to make the bees forsake it, and he will not hesitate to give the bees suffering from it a fresh clean hive as soon as he wisely can. A poor collier in applying for work was asked by the master of the colliery if he were acquainted with "foul air." He replied that he "was so well acquainted with it that he would not venture to have anything to do with it." Foul brood is as dangerous and destructive of health and life in a bee-hive, as "foul air" or foul damp is in a coal-pit. We are not going to waste time and space in theorising as to the cause of this distemper in bee-hives, which is not understood. Long and elaborate essays on foul brood have been printed from the pens of great and distinguished apiarians of both Europe and America, during the last few years; a careful perusal of which will convince any man of ordinary intelligence that the writers themselves are not quite certain as to the correctness of their opinions. The last, and every attempt made to clear up the mystery of foul brood, indicates that the person who makes it thinks that all who have gone before him have failed to a certain extent in their attempts. Some think that this disease is infectious, and spreads like leaven in meal, or spawn in a mushroom-bed, or itch on the human skin; and some go so far as to say that honey stolen from an infected hive will carry the disease to the hive of the bees that stole it. Though we are as unable to speak with authority or certainty on this subject as others, we may be excused for saying that we are yet to be convinced that it is in its nature infectious or self-communicating, or that it is ever carried in honey from one hive to another. That it spreads in an infected hive of living bees, all will admit; but a satisfactory explanation of the law or process by which it spreads we have never seen. Many single cells of foul brood, far asunder, in a

hive, often appear. These cells are covered with lids, rather flat, or slightly concave or scooped, resembling in shape the lids of honey-cells. The lids of cells containing healthy brood are slightly raised or convex. The disease spreads—the cells of foul brood multiply, apparently not by contact, but singly and separately all over the hive, like the berries of a bunch of grapes colouring one by one.

A great deal has been wisely written about chilled brood perishing and becoming foul. The bees of a hive full of brood seem to dread the exposure of their combs to a cold or chilling atmosphere. In the spring months eggs are as widely set as the bees can cover them; but if very severe weather overtake the hive and compel the bees to creep together for mutual warmth, some brood may be left outside their warmth and perish. Some years ago we placed a single hive in a garden of gooseberry-bushes. A mischievous boy found it, kicked it over for a "lark," and made his escape for a few minutes. The combs of the hive were all exposed, and remained in this position some days. The boy had cast a stone into the centre of the bees and hive, which we found on placing the hive on its board. In about fourteen days after we took a swarm from this hive, and gave it a younger queen. In the autumn we found foul brood in it, but as there was but little of it we cut it out clean, and put pieces of healthy comb in the place of those cut out. The hive did well the year following. Foul brood is often found in hives that have suffered more from heat than cold; those that are long on the point of swarming, and prevented by some cause or another from swarming, oftener catch the distemper than those not so full. In fact the non-swarmers are oftener affected with this disease than swarmers or their swarms; and this is an argument in

favour of the swarming system of management. By keeping young hives—that is to say, swarms of the present year—for stock, no bee-keeper will suffer much from foul-brood, if he ever suffer at all. If hives containing older combs are kept as stock, they should be carefully examined twice a-year to see that they are free from diseased brood. Three weeks after first swarms leave their hives, the combs contain no brood of the worker kind—a few drone-cells will still have healthy brood in them, as drones are twenty-four days in their cells. But by examining the hives from the 21st to the 25th day after swarming, a bee-keeper may see whether they have foul brood in them or not. By blowing the smoke of our constant friend and able coadjutor, Mr Fustian, down amongst the combs, the bees will leave them, so that we can see whether any cells have lids. If the cells are all apparently empty, the hives are clean, and eligible to be kept another year. If some cells have still lids covering them, suspect, SUSPECT, SUSPECT. At once proceed to drive the bees out of such hives and put them in empty ones. If the weather be unfavourable for putting such swarms into empty hives, they may remain till the weather changes. The second examination of stock to ascertain if they are free from diseased brood should be made in September, or just as soon as the breeding season is over, and the combs empty. If any are then found diseased, the bees should be driven out of them and united to healthy ones. There can be no prosperity in a hive containing diseased and stinking brood; and to the bee-master there will come from it loss and disappointment instead of profit.

CHAPTER XXXII.

THE ENEMIES OF BEES.

It has been said that swallows, sparrows, tomtits, frogs, toads, and hens, eat bees. We have never seen them, or any of them, do so, or even attempt to seize one; we are therefore very sceptical on this point.

Mice often rob bees of their honey in the winter months when they are sitting quiet and in little compass. Indeed they sometimes take up their winter quarters in a bee-hive, which they find to be comfortable every way. Mice dare not enter hives in summer when the bees cover all their combs. Experienced men contract the doors of their hives about the middle of September, and so contract them that mice cannot enter. The doors of our hives are about four inches long, and one inch high. We cut pieces of wood to fit the doors, in each of which we cut a small doorway, about one inch in length, and one quarter of an inch in height. These small doorways prevent the mice from going into hives, and allow the bees ample room for all the traffic they need, and for carrying out their dead during the fine days of winter. These contracted doors are useful in keeping not only mice and rats outside the hives, but they assist greatly in keeping up the warmth of the hives in cold weather.

Snails are very fond of honey, and frequently find their way into bee-hives, and there live and consume a great deal

of honey. Bees will kill a lion, but will not touch a snail —it is so cold and disagreeable to "the feel;" it is therefore allowed by the bees to go in and out without let or hindrance. The bee-master only can save his hives from the ravages of snails by killing all he can find in the neighbourhood of his bees. Hornets, wasps, and humble-bees seldom do harm, or get admission.

Bees of one hive often rob those of another. A hive of bees is a community of selfish creatures, which will, without reluctance or remorse, rob another community of all its stores. The greed and predatory habits of bees are very remarkable. Doubtless this greed or these habits are the outcome of their instincts of industry—instincts which make bees the greatest enemies of bees. If one swarm succeeds in its efforts to enter the citadel of another, it is sacked in a comparatively short space of time. When once a hive is invaded by a number of robbers, it can be saved only by removal. I remember a strong hive of ours being robbed by a second swarm belonging to a neighbour bee-keeper. This second swarm had stolen about 20 lb. in three days previous to our discovery of the robbery. We removed our strong hive to a distance of two miles (where it soon gathered as much as it had lost), and placed another hive on the spot where it had been robbed. Early next morning the robbers came for more plunder, when every attempt to enter the hive (placed there during the night) was resisted. The robbers, thus thwarted, instantly let the whole fraternity of their own hive know that it would be of no use to look to that quarter for more honey. Often have we seen hives assaulted again and again with spirit and determination, and every assault has been successfully and spiritedly resisted. These continuous and persistent attacks are owing to the fact that one or two of the enemy got access to the

city, and escaped with some spoil before the defenders were aware. It has ever been a marvel to witness the result of one bee having intimated to its companions that it has brought home a sackful of honey. How it communicates the fact, or how it commands them to go and do likewise, and how they are told where to go, we cannot tell; but we have seen them leave their hive in great numbers, on receiving the word of command, and sacrifice their lives in scores and hundreds ere the assault was deemed hopeless and unavailing. Attacks are sometimes suddenly made, and sometimes as suddenly ended. When the bee-master sees any of his hives assaulted, and every assaulting bee hurled back, he has little to fear; and all that he can do is to contract the door, and thus enable his bees to defend their citadel. If the robbers have no mercy, neither have the defenders. Each bee defending its hive is a qualified judge and executioner. If a robber is caught, lynch-law takes its course.

Bees know each other by smell, and they know strangers in the same way. If robbers are not resisted, and kept out of a hive at first, there is no attempt made to resist them after having been allowed to go in and out for some time. They soon pillage the hive of all its treasure. When this pillaging is taking place, the bees work late and early, wet and dry. Weak hives are generally the sufferers; but sometimes strong ones, while fully employed in gathering honey fast, suffer robbers to carry away what they gather, and all their stores.

Every experienced bee-keeper knows robbers by their stealthy manner of attempting to enter hives for plunder, and he knows them by the way in which they come out of the hives laden with it. This knowledge cannot be obtained by reading, but is gained by observation.

CHAPTER XXXIII.

TRANSPORTING BEES FROM ONE PLACE TO ANOTHER.

In some favoured districts bees remain from the beginning of the year to the end of it. The trouble or expense of removing them to a locality supposed to be better, would not be covered by the additional income. In other localities the heather is at so great a distance that it is not considered worth while to remove bees so far for the chance of having a harvest of moorland honey. But earnest men, who keep large strong hives, find it profitable to remove them to good pasture. We remove ours twice every year, first to the clover, then to the heather; but our neighbourhood is a very poor one for honey. If left at home, our best hives would not gain 1 lb. of honey each daily in favourable weather during the months of June, July, and August, whereas on the clover and heather they gather from 2 lb. to 6 lb. each daily. When the bee-keepers of this country awake to see the value of large hives, in the vast stores of honey speedily gathered by them, the practice of removing bees to better honey districts will become as general here as in some Continental parts, where carts are made on purpose, shelf over shelf, to carry hives. In hot weather, inexperienced persons find some difficulty in removing full hives, the combs of which are so apt to fall down and melt by their own heat. Great care is required in removing such hives; for when-

ever a hive is closed up to keep in the bees, natural ventilation comes to an end, and moreover, the commotion of the bees caused by the first and continued motion of the hive increases its internal heat. The bees of hundreds and thousands of hives are suffocated in being removed to the moors. Young gardeners generally steam or stew to death their first plants of cucumbers, and young bee-keepers often destroy one or more hives in their first effort to transport their bees. In rainy seasons and cold winters, weak hives suffer most, but in being transported from place to place they suffer least. When suffocation takes place, it is almost always in one of the best hives.

In considering this subject, the value of cross-sticks in each hive to support its combs will be seen: indeed they are indispensable, for if combs are not supported and kept steady by these cross-sticks they are easily shaken down. Sticks are otherwise of great advantage in hives, being used as by-lanes by bees in going from comb to comb.

There are various ways of saving bees from suffocation in removing them. The admission of plenty of fresh air into their hives is the secret of success. By admitting air enough, and confining the bees to their hives, we can safely transmit them by cart or waggon or rail, one hundred miles, or five hundred miles if need be.

Our mode of confining bees for removal from one place to another is as simple as it is safe. The doors of our hives are pretty large, and the holes in their crown are also large, some four and some five inches in diameter. We nail a piece of fly-proof wire over their mouths and crown-holes, then tie the hives tightly to their boards with strong string or cord, and sometimes drive three two-inch nails through the bottom rolls of the hives into the boards. They are thus prepared to bear pretty rough handling. The fly-proof wire at the doors and on the

tops secures ample ventilation for hives as full as they can be; indeed this ventilation is so great that the heat of full hives is less at the end of a short or long journey than it was before they started. If hives are not full or crowded with bees, we do not often use the wire on their crown-holes. The wire at their doors, and a few thin wedges or penny-pieces slipped in between the hives and their boards, before they are tied together tightly with the string, prevents suffocation. They travel safely. The nails are used to make all doubly secure. If hives travel over a rough road on a cart, the jolting sometimes causes them to move on their boards, especially if the bottom of the cart is not level. The nails, either through the rolls of the hives, or outside of them, driven partly into the boards, prevent the hives from moving laterally or off their boards. Of course hives are thus prepared for travelling either before the bees go to work in the morning, or after the outdoor labour of the day has closed. In this way not a bee is lost, and the cool of the day is the better time to transport and transplant hives. If the weather be cold or rainy, the bees may be all caught during the day, confined, and their hives tied and secured as described already, and transported. In fact, the colder the weather is, and the less the bees are at work when about to be transported and transplanted, the less danger there is, for in cold weather the bees need far less ventilation. We take our bees twenty miles to the moors, part of the way on carts, and the rest of the journey by railway, without having misfortunes and breakdowns. Indeed we cannot conceive a more efficient, safe, and easy mode of insuring the safety of hives while being moved from place to place than the one now described, and which we invariably practise.

Hives without cross-sticks, such as bar-frame hives, are

exposed to great risk in being moved at all if they are not full of combs. Sometimes they are turned upside down while being transported, in order to prevent the weight of the combs helping to detach them from their holding-points. Even in this position they will suffer much if slightly shaken or jolted. When the distance is short, and the combs insecure, hives should be removed on hand-barrows in their natural position. Some bee-keepers place their hives on thin towelling, which is tied over their mouths, and which answers for ventilation in their transition. We knew a case of bees eating through this towelling. They were sent from Scotland to London well tied up in it. They were sent on a carrier's cart thirty-three miles to Edinburgh, to be shipped at Leith for London. In the centre of the city of Edinburgh the bees escaped in great numbers. The carrier's wits made him purchase two sheets of fly-proof wire, which he speedily placed over the towelling, and thus saved the hives from losing more bees. The hives arrived in London safe, and though considerably reduced by the loss of bees in Edinburgh, they did well next season in county Middlesex.

When hives are so full that some of their bees are clustering outside, they should be enlarged with ekes or nadirs one or two days before they are prepared for removal to a distance. When such hives are to be removed but a short distance for the convenience of watching them swarm naturally, they can be safely carried on hand-barrows *after ten o'clock at night*, without closing their doors at all. Like well-behaved people, bees keep to their homes after that hour.

On arrival at their destination, all hives should be speedily placed where they are to stand, the wire on their crowns removed, and their own lids put on, then covered, and their doors opened. If the weather and time of day

be favourable for honey-gathering when the bees arrive, they will begin to work in less than fifteen minutes after having been set at liberty, if they have not suffered during the journey. How quickly bees find honey-flowers and return with loads from them may be seen in placing hives in a strange locality on a fine day. If they have suffered from being over-heated by the way, the bees will not go into full work for one or two days afterwards.

CHAPTER XXXIV.

THE SELECTION AND PREPARATION OF STOCK-HIVES FOR ANOTHER YEAR.

This is a very important matter in the profitable management of bees, and "bad luck" is often the consequence of inattention to it. When we see our hedgerows and the fruit-trees of our orchards covered with blossoms in spring, we should not forget that we are indebted to the autumn suns of last year for the beauty and abundance that meet our eyes. Those suns ripened the wood, filled the buds, and set the flowers before the cold and snows of winter came. This year's suns can develop those buds into blossoms and fruit. So the autumn treatment of bees is to be considered of primary importance.

In selecting hives for keeping, one should have his eye on many points.

Those that are full of combs, well built, and as free from drone-cells as possible, are to be preferred to those that are not full of combs, or that contain much drone-comb. In the spring months, or in prospect of breeding young queens for swarming, bees do build much drone-comb, hence it is very desirable to select hives in autumn that are filled with combs, or nearly so; for, as we have seen in the chapter on the sex of eggs, it is the number of drone-cells in a hive that determine the number of drones bred in it.

In this work of selecting hives for stock, the age of queens must never be lost sight of or forgotten. All the old queens will be found in the top or first swarms, and if any of these containing queens more than two years old be selected for stock, it is desirable to remove and destroy the old queens, and put younger ones in their places. All parent hives, second swarms, and turnouts have young queens. Second swarms and turnouts, with pretty and closely-built combs, weighing from 36 to 50 lb. each, make excellent stock-hives. If some of them have faulty combs, or are otherwise objectionable, they are marked for honey, and the parent hives kept for another year.

First or top swarms in ordinary seasons are too heavy for keeping, and are therefore generally put down for honey, but in rainy seasons they are often kept for stock.

Now, let us suppose a bee-keeper has twenty hives at the end of August, ten for stock and ten for honey. Should he apply the brimstone to the ten for honey? No, and again we say no; but drive the bees out of them, and unite them to those selected for keeping. This is a consideration of prime importance; for hives thus plentifully furnished with bees in September are worth much more than those which, being otherwise equal, receive no additions of bees from without. Hives thus strengthened are well able to bear the difficulties of cold winters; they swarm about a month sooner than others in spring; and their first swarms, in fine seasons, will have their hives filled with combs, and be nearly ready to swarm themselves, before hives not so skilfully and liberally dealt with begin to swarm at all. No poor words of ours can describe the value of this hint. Let it go and be circulated widely with that of large hives, and the success of those who carry it into practice will soon stimulate the attention of those who do not; the awful brimstone-pit,

now used to destroy valuable lives, will soon be considered as something which belonged to "the dark ages." The way to unite swarms is simple and easy, and will be explained presently.

But here let me say that hives so well filled with bees in autumn require more food in winter than those not so well filled. A Continental writer, "a Swiss clergyman," has broadly stated that two swarms united eat no more honey than each does separately. This wild notion has now a pretty wide and free currency, having been quoted by one writer after another. Some experiments have been made by honest men to test the truth of the statement. The results, as recorded, go in favour of the clergyman's opinion; but what strikes one is the exceedingly small quantity of honey eaten by the swarms doubled and trebled in the recorded experiments. Neither single, nor double, nor treble swarms eat more than 7 lb. of honey from September till March, whereas each of our strong hives consumes 15 lb. in the same space of time. Who can *rationally* account for the difference of 7 lb. and 15 lb. if numbers are not considered? We think the clergyman is wrong in his statements and doctrines as to the food required by bees in winter. It were easy to put bees enough into a hive to consume 7 lb. of honey in a few weeks of autumn. Let bee-keepers remember the words of Burns—

"Twa mouths are waur to fill than ane;"

and that 50,000 bees require about as much honey in one hive as they do in two.

In the autumns of rainy seasons, what should be done with hives containing but little honey? The bees of them should be united to others selected for stock. If there be not more than 5s. or 6s. worth of honey in each hive, it is better to let it remain in the hives and combs, and be care-

fully preserved till the following spring for new swarms, than to break it up for honey. A hive of fresh empty combs is worth 7s. at least for receiving a swarm. Three years ago two good swarms came off on the 20th of May. One was put into an empty hive, and the other into one containing some young sweet combs. In about two months the swarm that was put into the empty hive weighed 70 lb., whereas the other that had the advantage of the combs weighed 90 lb. The swarm, on being hived amongst the combs, was apparently a little less than the other. A hive even half or a third full of young combs is a great advantage to a swarm, for the bees at once begin to collect honey and set eggs. If it be desired to feed the hives kept with the honey in those that are to be set aside for swarms next season, it is easily done by placing the comb-hives under the bee-hives for a single night, when the bees will go down and empty every cell of honey, and carry all up into their own combs without injuring the combs of the beeless ones. Thus the weak ones are made to feed the strong ones in unfavourable honey years.

But one of the greatest difficulties which overtake a bee-master well up in the profitable management of his stock, is when all his hives become too heavy for keeping. Some seasons his second swarms and turnouts and old stock-hives will rise in weight to 70, 80, and 100 lb. each, and first swarms will go 30 lb. or 40 lb. beyond that weight. When this happens, both the season and the locality are favourable for honey-gathering. Well, what should be done with such heavy hives? Put them *all* down for honey and honeycomb. The profits in such seasons are very great. But if all the hives are put down for honey there will be none for stock. Stop a little. There are three ways of keeping up the number of stock-hives and yet getting honey from all the hives.

1. One is to drive the bees out of the heavy hives before the honey season ends, and put two swarms into an empty hive. A few days of honey weather will enable the bees to fill their new hive with combs, but there will be a proportionate loss of honey by interfering with heavy hives before the season is over. When two swarms are thus united, the oldest queen should be destroyed before the union takes place.

2. The second way is to select the proper number of stocks from these heavy hives, and greatly reduce them in weight by freely using the comb-knife in cutting out 20 lb. of honey or more from each hive, and uniting the bees of those that are wholly put down to them.

3. The other way of meeting the difficulty is the best, though it causes a little more trouble to carry it out. The bees are allowed to gather all they can in their own hives till the season ends, which is generally about the commencement of September. Suppose we have twelve or fifteen hives, and wish to have six stocks. Well, all the bees are driven out of the heavy honey-hives into empty ones, and united in pairs in 16-inch hives—that is to say, all the bees of the twelve or fifteen hives are put into six empty ones, with cross-sticks in them. If the swarms are very large, these hives will hardly hold two; in that case they should be enlarged with ekes. Now they are to be fed *vigorously*, each hive to get 25 lb. of sugar boiled in its own weight of pure water. In some cases that is not enough. The feeding-boards are the best instruments to use in giving such large quantities to bees for comb-building and storing up. The 25 lb. of sugar will make about 50 lb. of syrup. All this should be given to a hive so filled with bees in ten, twelve, or fourteen days. The door should be well contracted, and the hive kept warm, to promote comb-building. Large garden-saucers or soup-

plates may be used instead of feeding-boards; but their use necessitates the lifting of the hive every time the bees get a fresh supply of syrup. By the end of fourteen days every hive so filled and fed will be found nearly, if not quite, full of combs, and many of the combs well filled with eggs and brood. When the bees creep together by reason of colder weather, their ekes may be taken from them; and if some of the combs have been built down into the ekes, they should be shortened to fit.

These sugar-fed stocks are generally very prosperous hives next year, their combs being young and containing scarcely any farina. Almost every cell yields brood in spring. But it should be stated and understood that combs made from sugar are more brittle and easily broken than combs made from honey gathered in the fields. We have frequently known every hive put down for honey, and all the stock prepared as now described. We think it was in 1864 when a cousin of ours realised £40 profit from nine stock-hives. He found all too heavy for keeping, hence he took all the honey, and formed his stock by feeding.

CHAPTER XXXV.

THE BRIMSTONE-PIT.

This was invented, and has been used from a very ancient date to the present time, for the purpose of wholesale destruction. Without such an "institution," how could the poor cottagers of England get their honey? They have used the brimstone-pit, and will continue to use it till they find out a better way of removing the bees from their hives marked for honey. We may be excused for giving here a brief description of this way of destroying bees.

Some brimstone is melted in a plumber's lead-pan over a slow fire, and while in its liquid state some rags are dipped in it. These rags, now covered and stiff with brimstone, are cut into pieces about three inches square. One piece is enough for a hive. The pit is about twelve inches square—rather wider for large hives. The brimstone-rag is placed in the cleft of a short bit of wood which is stuck into one of the sides of the pit. A cabbage-leaf, or anything else, is placed above the rag to prevent the bees from falling on it, and thus putting it out when burning. Now the match is applied, and the brimstone begins to burn with a blue flame, when the hive is instantly lifted off its board and placed over the pit. Some soil is thrown around the bottom of the hive to keep in the gas, which does its awful work in two

or three minutes. The community thus stifled fall from their combs into the pit—destroyed, but not killed. To put them out of misery a kettle of boiling water should be poured upon them, which causes instant death.

We are no advocates and patrons of this plan of destroying bees. We do not use the pit, or ever attempt to put to death whole swarms of bees. We think it bad policy to do so; but we cannot agree with some sentimental folk who hold up the practice as one of inhumanity. It is not more cruel to destroy bees for honey, than it is to knock a calf on the head in order to get milk, or to drive the pole-axe into the brains of a bullock with a view to get beef. And what about cutting the throat of a sheep for a bit of mutton? There is nothing in the destruction of the lives of bees more cruel and inhuman than there is in the destruction of the lives of cattle, sheep, and fowls. There has been given to man a power over the inferior creatures, the proper use of which is an advantage and blessing to the human family.

CHAPTER XXXVI.

ON DRIVING AND SHAKING BEES FROM HIVES AND UNITING THEM TO OTHER SWARMS.

Though often touched on before in other chapters of this work, these matters deserve separate and distinct treatment.

Given a hive full of combs and bees, and an empty one into which the bees are to be driven. After the full hive has got a few puffs of smoke, it is turned upside down, the empty one placed on it, mouth to mouth, and a table-cloth is tied round the junction of the two hives to prevent the escape of a single bee. The drumming or driving now commences, simply by beating the bottom hive with open hands. This beating confounds the bees and makes them run upwards. In running up into the empty hive the bees make a great noise as in swarming, and this noise facilitates the work in hand. In hot weather all the bees, or almost all, may be thus driven out of a large hive in twenty minutes. The drumming should be continued the whole time, for if the bees have time given them to think, they will cease running up, the noise will abate, and those that are below will cleave to the brood-combs to keep them warm. In driving bees the work should be done quickly, allowing no time for play or palaver.

In cold weather this work is more difficult to accomplish, the bees then being more disinclined to leave their

own comfortable habitations. But the work has to be done, and the bee-keeper's ingenuity will not forsake him in front of a job of this kind. About ten minutes before he commences to drive the bees from a hive in cold weather, he will remember to turn it up and pour about half a pound of sugar-and-water amongst the bees, and then place it on the board. Every bee gets a feed. The heat of the hive speedily rises twenty or thirty degrees, and by the end of ten minutes the mirth and noise of the hive will be great. If the empty hive has been outdoors, or standing in a cold place, it should be held before a fire for a minute or two before it is placed on the other. The bees are now easily driven up: they run as fast and furious under such treatment as they do in the warm days of July or August. It is a hard-fought battle that kills every soldier, and it is an unusually successful achievement when all the bees are driven from the bottom hive. Sometimes a few dozens will refuse to leave the hive. The brimstone-rag will soon clean them out, and we do not hesitate a moment about applying it to destroy a few stragglers.

When hives are less than 30 lb. each, we take their bees from them by a speedier mode than driving: we shake them out in *less than half a minute.* When this is done no smoke is used: the bees are taken unawares. The hive to receive the bees is placed on its crown; the other is gently raised off its board, but not turned up. The bee-master now places his fingers inside the hive and his thumbs outside—the hive being fairly balanced on his hands—and his legs pretty well astride the empty hive. He now acts as if he were going *to dash* the one he holds against the other, but they never touch; the bees, however, go forward and fall into the empty hive. A few violent thrusts or shakes, well performed, is often

enough to empty the hive of every bee. In cold weather, when bees are sitting fast among their combs, they cannot be shaken out in this manner without first feeding them as described above. A few minutes after having been fed they will be found moving lightly about over their combs, when they may be readily and easily shaken out in less than half a minute. This expert "express" mode of driving bees from light hives is very useful to us, for we have many to drive and little time to do it. But the thing is so simple and easily done, that the biggest novice in the world in bee-management could, on seeing it once done, do it well. When we throw a little water out of a glass we first put them in motion. At a certain point we stop the glass from going farther, but the water goes forward. And when we attempt to kick the doorstep to shake the snow from our boots, the foot is put in rapid motion, which is suddenly stopped by the step, but the snow goes forward as far as it can. Thus water is thrown or cast out of a glass, and snow cast from the boot; and so bees, when taken unawares, are cast out of a hive by the law of motion. We often perform this operation by candle-light. By feeding the bees about sunset and taking them into a room, or barn, or hothouse, in about half an hour afterwards they can be readily shaken out on the floor of the room, and a hive placed over them; and sometimes there is not a bee lost in doing it. Of course the hive containing the bees should be placed on its stand before they begin to fly next morning.

Hives beyond 30 lb. are not so easily handled. A man of ordinary strength is unable to put them in motion rapid enough to make the bees loose their feet-hold and go forward.

We have successfully used contrivances for shaking bees from heavy hives; but we consider the reader will

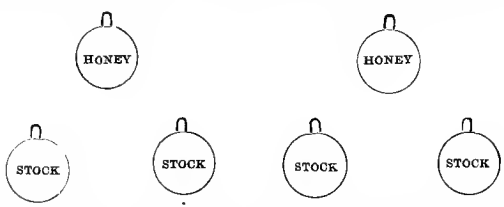
do well to cleave to the common way of drumming bees out of heavy hives till his own experience gives him courage and adroitness to enable him to achieve more difficult operations.

The art of uniting swarms is a very valuable one, and easily learned. The hive to receive the bees, or additional swarm, is turned up, some sugar-and-water, strongly scented with mint, is poured over the bees, when the other swarm (temporarily driven into the empty hive) is shaken over and amongst the bees, combs, and sugar, and some more syrup sprinkled over them. The hive is now placed on the board, and the work is done. This minted syrup prevents the bees from discovering which are strangers, and therefore prevents fighting. On the Continent the bee-keepers have begun to use nutmeg grated in the syrup, which they give to bees when uniting them. It is the same idea and same practice. If the nutmeg smells stronger than the mint it is better for the purpose. We could unite a hundred swarms successfully without the use of either mint or nutmeg; but these strongly-scented articles used in the marriage-feast of two swarms tie the knot at once, and cement a union lasting as life. When the swarms are united about sunset, and plenty of unminted syrup is given to the bees, they rarely ever kill each other. When they do, the work has not been well done.

Observing parents and teachers of children do not fail to notice the immediate effects of placing sweets in the mouths of young people. A kind of intoxication or hilarity comes over their minds; and when this takes place it is rather a difficult matter to make them angry and cross-tempered. All this kind of thing happens in a hive if the bees are well fed with sugar; it is therefore wise to give them enough about fifteen minutes before the

other swarm is shaken amongst them. A swarm may be divided between two hives, or three, as successfully as when wholly given to one. We are now speaking of uniting bees in autumn, when it is customary for many to destroy them by brimstone.

The oldest queen of the two swarms should be killed before the bees are united. And it is necessary to remember that the hives standing *against* each other in the same garden are most eligible for being united, as each swarm will be near its own stand. When our hives are brought home from the moors we place the honey-hives in front of or side by side with those marked for keeping, thus :—



Here the four stock-hives get the bees of the two honey-hives, and if there were four honey-hives the stocks would get a whole swarm each.

But suppose a honey-hive has been standing at some distance from those we wish to strengthen by its bees, how can we act without risk? There is some, if not great, difficulty in arranging such matters.

1 2 3 4 5 6 7 8 9

Suppose we want to get the honey from No. 2, and strengthen with bees 7 and 9. If the bees of 2 were to be put in 7 and 9 they would return to their old stand, and probably be killed at the doors of 1 and 3. In such a case we drive all the bees out of 8 and unite them to 7

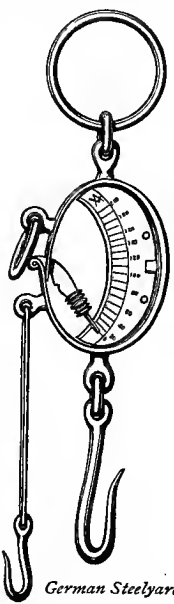
and 9. Then we drive the bees out of 2, and throw them into 8, which takes the stand of 2, leaving 8 without a hive. Thus the honey is obtained and all the bees preserved.

Sometimes it is desirable to unite the bees of two weak stocks in the winter season or in cold weather. This is done by candle-light in some room or house. The bees of the hive to be surrendered are fed by sprinkling syrup over them. In about fifteen minutes after, they are suddenly shaken on the floor, and the other hive, having been sprinkled in like manner, is placed on the bees. We have never known an unsuccessful effort made to unite bees thus by candle-light. Of course the candle must be speedily removed, as bees naturally fly to the light, and creep along the floor towards it. And before daylight next morning the united bees must be placed where they have to stand. A little self-confidence, and a fair share of celerity, will enable any bee-keeper to accomplish easily all he wishes to do with his bees.

CHAPTER XXXVII.

ON TAKING HONEY AND WAX.

When we lived in Oxfordshire, we were pleased to find the cottagers there could sell their honey in the hives. Certain honey-factors came round every autumn, and bought honey-hives at sixpence per lb. gross weight, after the bees had been killed by brimstone. We then thought, and think still, that the cottagers got a fair price for their honey, and doubtless the factors got a fair margin of profit.



German Steelyard.

It is not difficult to know pretty accurately how much honey is in a hive before the bees are removed from it. Here is an illustration of a German steelyard, which is a handy instrument for weighing hives. The dial or plate is figured on both sides—one side for the large central hook and ring, numbering from 1 lb. up to 200 lb. The other side indicating from 1 lb. to 40 lb. only, is used when the hive is lifted by the small hook and ring seen on the left-hand side.

To ascertain how much honey is in a hive, we have a rule or standard of calculation which comes near enough to certainty in this matter. After deducting the weight of hive, board, and bees, we reckon 5 lb. of honey for every 7 lb. weight. Suppose a hive weighs 60 lb. The hive and board may weigh 10 lb. jointly, and the bees 8 lb., leaving 42 lb. In this case there are 30 lb. of honey and 12 lb. of offal or refuse combs. Another hive may weigh 100 lb., the hive, board, and bees of which may be 23 lb.—leaving 77 lb. According to our standard there would be 55 lb. of honey and 22 lb. of offal. In the case of hives containing old combs, the yield of honey is less in proportion to weight than it is in young or virgin combs. Again, if the brood be all hatched, there will be less offal and more honey. And we need not add that the yield of poor lean hives will be found wanting; and that in the yield of very fat ones there will be found a surcharge of honey.

But let us come to the process of taking honey. As soon as the bees are driven out, the honey-hives should be carried into a warm room, and not allowed to cool, for it is very difficult to impart heat to honeycombs. The sticks crossing the combs are withdrawn by a pair of pincers, the combs removed from their hives, and the honey portions of them carefully cut off and placed on a flat dish or milk-pan, standing near the fire, but not so near as to melt the combs. Any pure white comb may be set aside for sale as it is, and all the rest containing honey be broken up with a knife, and then put into a bag of cheese-cloth or thin towelling to drain off into a vessel placed underneath. The honey thus drained is as pure as it possibly can be, and is much better than if pressed out of the combs by the hands; for honey so pressed or squeezed out is impregnated with the taste or

flavour of farina or bee-bread, and is slightly discoloured by it. We very much disapprove of the hand-squeezing mode, for though it secures the greatest weight of honey, it does so at the expense of quality. In taking clover or flower honey, no squeezing is absolutely necessary; but in the case of heather-honey some pressure is required, for it will not run without it.

We have seen instruments for pressing honey from combs. Though small and imperfect, they did their work well, but the process was slow and tedious. We earnestly hope that the ingenuity of some bee-keeper will soon furnish us with an instrument which will enable us to take hundred-weights of honey from combs easily and speedily.

We are sorry that we cannot give the reader one useful hint in the matter of extracting honey from combs, for every old woman in the country is as well posted and accomplished as the author; indeed it is a question if the people of the times of Methuselah were not quite as well up in this work as we are. We are earnestly seeking for a way that will save both time and toil in this business.

After all the honey has dripped into the vessel and been skimmed, it is ready for sale.

Wax is obtained by putting the refuse combs into a bag of cheese-cloth, and boiling them in a large pot of clean water over a slow fire. If the bag be pushed to the bottom of the pot and held there by some contrivance, all the better. The wax speedily comes to the surface of the water, and appears there as a beautiful yellow oil or fat. This oil is ladled into a bag of fine cloth or strainer, through which it passes into vessels. The wax may be boiled again in clean water, and put through the bag once more, and thus become purified. Combs that yield £10 worth of honey, yield rather more than £1 worth of wax.

CHAPTER XXXVIII.

ON WINTER TREATMENT.

Doctors differ in their opinions as to the treatment bees should receive in the winter months. One says, keep them warm—another says, keep them rather cold; one suggests a nice warm spot facing the south—and another recommends all hives to face the north, lest the warm rays of the sun tempt the bees to come out when the atmosphere is too chilling. One prefers to winter bees in the garret, and another has buried them in cavities underneath the ground. In America some large bee-keepers have erected large houses on purpose to hold their hives during the winter months. These houses are perfectly dark, and the hives are placed upside down on shelves, with all their combs exposed to the air of these dark rooms. The bees are thus kept in perfect darkness for months, in a position which permits the exhalations of their bodies to pass away from their hives, but not their excrements. These houses are meant to protect bees from the severity of American winters. For large apiaries of *wooden* hives these houses answer well in North America. In Great Britain they are quite unnecessary: here bees can be kept sufficiently warm without anything of the kind.

Would you keep bees warm, then, in winter? Yes; as warm as possible out of doors, so that they get fresh air

enough to breathe. The importance of keeping bees comfortably warm in cold weather cannot well be magnified. They are easily benumbed by cold, easily chilled to death. When a bee drops into snow, it seems to die sooner there than if cast into a hot fire. Though bees apparently die on touching soft snow, they are not quite dead, for if speedily gathered and carried to the heat of a fire, they recover their powers. When snow is on the ground, especially if the wind is coming from the west or south, all hives should have their doors closed, so as to prevent bees from leaving them or coming out.

But let us now see what injury cold frosty weather does to bees not sufficiently covered. In such weather bees creep very close together, but some of them must necessarily be more exposed to the cold than the rest. Those on the outside of the mass or swarm as it sits among the combs suffer most. They often become benumbed, and lose all powers of motion. The rest creep closer together still, leaving them to perish in their helpless condition. Nine-tenths of the hives of England are thus weakened for want of sufficient protection in cold winters. Weak hives are often killed outright by cold. We all like an additional blanket or two to keep us warm during the cold nights of winter. Bees need extra covering too, and they cannot well get too much of it. Underneath the straw covers already recommended, we advise all our bee-keeping readers to use plenty of other materials. Soft dry hay, two or three inches thick, placed around every hive below the other covering, is an admirable protection from cold. In the absence of hay, waste cotton, tailors' clippings, rags of any kind, pieces of old carpets, bags of sawdust, paper or fine wood-shavings, or soft grassy sods well dried, will, if properly placed around hives, be a great and valuable

protection to bees in severe winters. The seeds of consumption, and other diseases of the human frame, have been sometimes sown at a date more ancient than we think about; and so the "bad luck" of many bee-keepers in the summer time could be traced to their bad management during the winter time. Warmth as well as dryness for bees in winter is of prime importance in every apiary in which profit is sought.

If hives be not cosily covered in autumn, the honey in them soon candies or crystallises; and after this crystallisation takes place, the honey does not last so long, that is to say, less of liquid honey serves a hive than when it is in a candied state.

About the end of September, when all stocks have received some additional bees, and feeding if necessary, they should be neatly plastered to their boards with mortar mixed with cow-dung, and then covered up as has now been described. The doors of the hives are contracted at this time, as has been mentioned elsewhere. No more attention is necessary for five or six months, save that of keeping the bees inside their hives when snow is on the ground. But here let us say that bees breathe and require fresh air in winter as well as in summer, and hence care and thoughtfulness are required in closing their doors to keep them in. Bees in a wooden hive soon perish if their door be closely shut. Bees in straw hives will be suffocated too if their doors are closely shut for some time, especially if their hives have been crowded in autumn by the addition of extra swarms. Forgetful and inexperienced people would do well to use fly-proof wire or perforated zinc for keeping bees inside their hives while snow is on the ground. And during long storms, the lives of very weak hives may be preserved by taking

them indoors—that is to say, into a room of a dwelling-house. Can bees be wintered beneath the ground? We have never tried to winter them there, but it has been tried in America, where it was found that, though they lived there, they consumed as much honey below as they did above ground. The dampness of the air below ground, as might be expected, rotted their combs.

CHAPTER XXXIX.

WHEN SHOULD HIVES BE PURCHASED?

Some one who has no bees may have condescended to read thus far in hopes of finding information as to the best time to commence bee-keeping. We think September is the best time to purchase hives for stock, for then almost every bee-keeper has some to part with—viz., those which he has marked for honey. If he can get the value of the honey-hives and boards he will readily sell them, and thus save himself the trouble of running and selling the honey. The taking of honey and wax is to us the most disagreeable thing in bee-keeping, and we would much rather sell our hives than put them down for honey. This month is the cheapest time, too; for hives that have weathered the winter storms are higher in price, because all danger is over, and they are nearer the time of multiplying their numbers. A hive before winter worth 20s., is worth 30s. in spring if all has gone on well in it. Bee-keeping can be commenced with May or June swarms, or in fact at any time. We sell our first swarms, put in good new straw hives with boards, for 25s. each; without hives and boards, for 21s. each. Second swarms are 5s.

each less in price. Those who can buy hives in their own neighbourhood should commence with them, and those who cannot buy at home should purchase of some respectable man elsewhere, and have them carefully transmitted.

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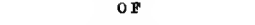

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